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Electrical World

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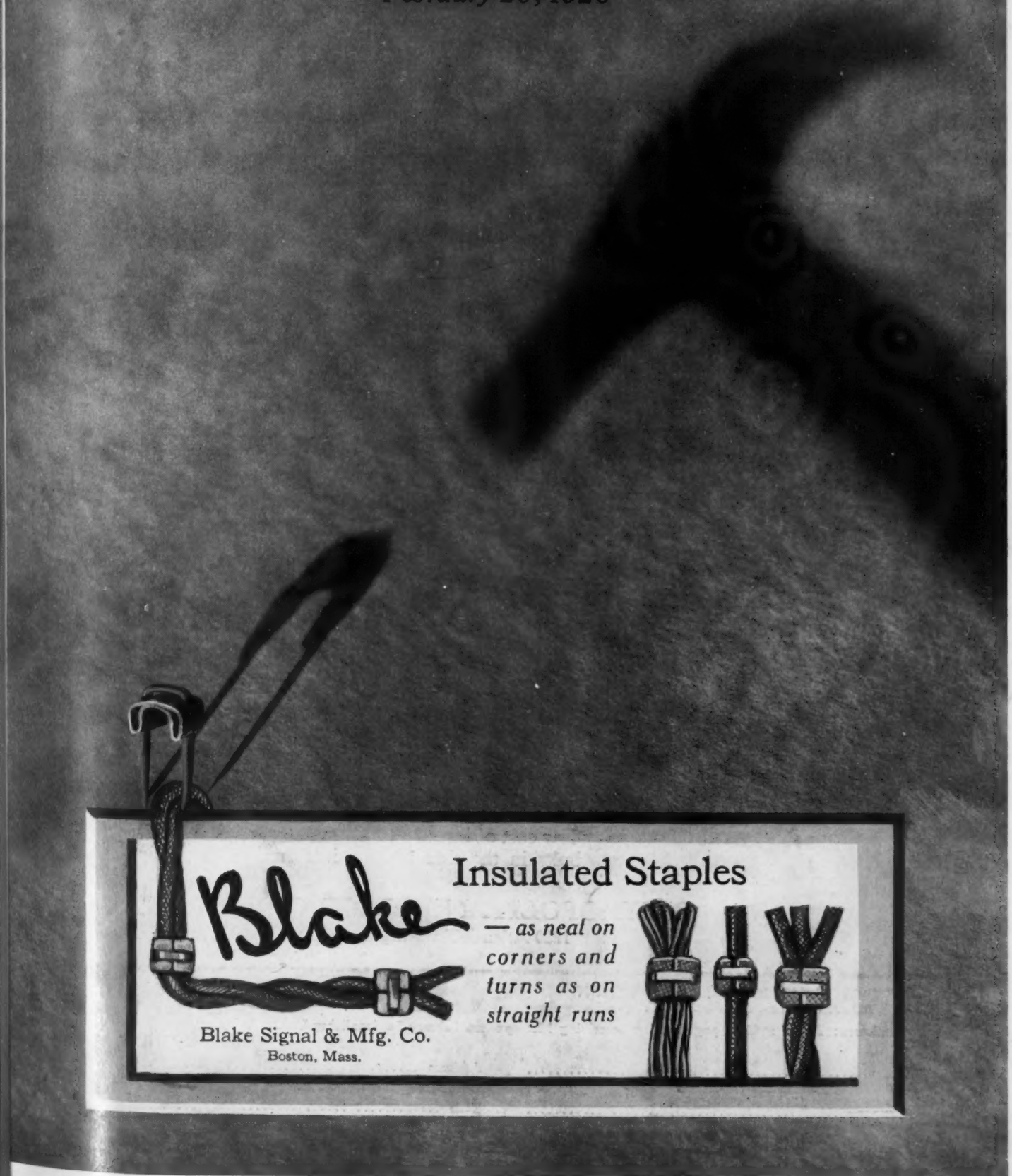

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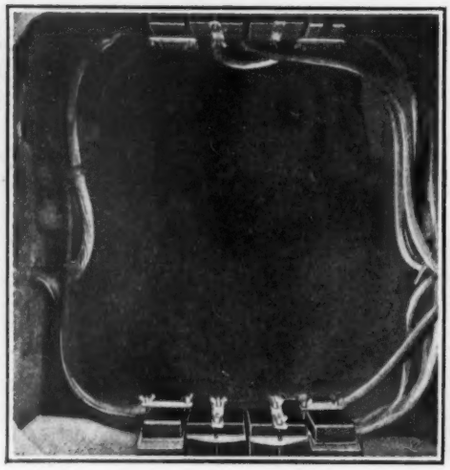

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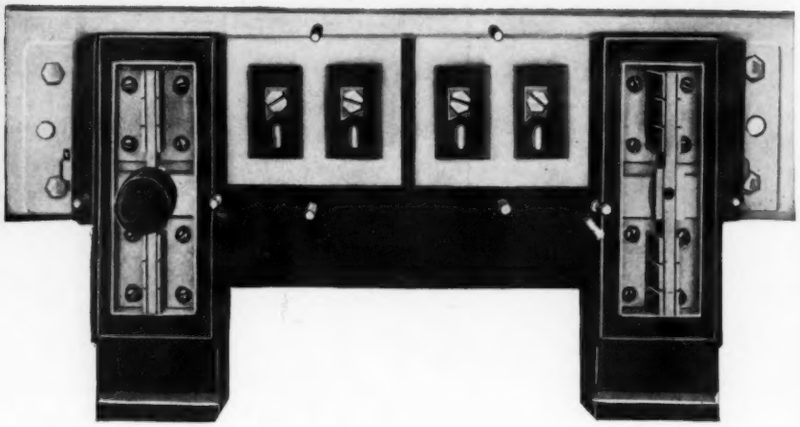

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Electrical World

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W. H. ONKEN, JR.
Editor

VOLUME 87 — *New York, Saturday, February 20, 1926* — NUMBER 8

What "Giant Power" Has of Good Will Survive the Bills' Defeat

GOVERNOR PINCHOT'S second attempt to get the Pennsylvania Legislature to adopt his "giant power" program will probably fail as lamentably as his first. The reason is not hard to find, for the Governor has not made out a good case. He has been unable to show to the satisfaction of the Legislature, or, for that matter, of the citizens of the commonwealth, that the electric light and power industry of Pennsylvania has been derelict in its duty. On the contrary, it has been shown that the electric public utilities of the Keystone State generate approximately one-tenth of the total energy produced in the United States and that the rates are on the average lower in Pennsylvania than in the neighboring states.

Moreover, the "giant power" program has never been properly investigated by disinterested engineers. All that has been given out on it has emanated from the Governor's own chosen board, and the Governor himself has shown little tolerance for other testimony. Naturally, no legislature that was not boss-ridden would act favorably on such a case, and Governor Pinchot and his coterie of advisers have only themselves to blame for this latest fiasco. "Giant power" thus passes into the limbo of forgotten things. Whatever of good the program contained will doubtless find its way into practice. The electric public utilities are, if anything, sanely progressive and aggressive. It is their business to generate and sell electricity, and their salvation rests in generating it more cheaply than any one else. Therefore anything that makes for economy of production will in the ordinary course of events be adopted. The Governor of Pennsylvania may thus rest assured that, notwithstanding the present fate of his pet measures, whatever of promise or merit they contained will, as has just been said, not die with the bills themselves, but, disassociated from the undesirable and the impracticable, soon be translated from the realm of theory and applied to the confronting conditions.

Measurement of Business Returns

MOST light and power company executives should know more about the financial returns on the several classes of customers they serve. They have built a great physical structure of stations and lines and have developed an operating organization, but there remains the great task of improving the service and increasing the consumption by present customers. In any intelligently conducted business it is a wise step to analyze costs and determine returns. Opinions and estimates have their place, but if at all possible each utility should know definitely the investment made, the operating costs and the returns for each class of business served.

General statements are very dangerous things and usually handicap developments. Statistical analyses made on a national basis may be entirely misleading when applied to an individual property. For example, the ratio of capitalization to gross revenue varies from 0.79 to over 16 in a group of 30 operating properties, and in the same group the gross revenue per customer varies from $62 to $792. Then, again, in a group of fourteen large operating utilities the load factor from 1920 to 1925 changed to 8 per cent lower or to 14 per cent higher, depending on the property considered.

But worse than the use of generalized figures to prove special cases are offhand opinions. One executive may say he thinks power business is taken on at a non-profitable rate, another may say that residence business is unprofitable, and still another may have negative opinions about the value of commercial lighting, ranges, water heating or other special classes of business. And the generalized figures and opinions may extend into the realm of rate making, which, when handled properly, is the place for adjusting returns to investments.

A wise executive of a utility today will try to allocate costs, investments and returns to classified businesses, so that he will know what loads to develop, what rate changes would be advisable and what return he gets for each of his classified services. While this is a difficult job, it can be done, and it is necessary that it should be done if the industry is to develop intelligently.

A Good Midwinter Institute Meeting

EVIDENCE that electrical engineering has become highly diversified could be found readily at the midwinter meeting of the American Institute of Electrical Engineers. Each session—indeed, each paper—treated of a different subject from the others in a highly specialized manner, and it was difficult for any engineer to understand fully all the papers or to weigh them with respect to their contribution to the art.

A large proportion of the thirty-five technical papers fell into one of three classes—power, electrical theory and communication. The sessions on transmission and dielectrics and several machine papers dealt with some phase of the art of producing and transmitting power. System stability, dielectrics for cables, machine characteristics and details of control and protective equipment, while seemingly separate topics, in reality are parts of the complete engineering scheme for producing and transmitting power. Limitations in equipment are studied in order to do a better and more economical job of building power systems for giving electrical service. It is evident that many of the existing limitations exist because sufficient engineering thought was not given in the past to the planning of systems as an assembly of equipment capable of meeting future requirements in service.

While progress could be recorded in the papers presented at the convention, there remain ample opportuni-

ties for engineers to treat the subject of power production and transmission in a much broader way so as to develop principles for extending and consolidating the systems now in existence.

The theoretical phases of engineering were treated at length in several papers. The phenomena of dielectric absorption, the fascinating study of the Kennelly-Heaviside layer and its effect on short-wave radio transmission and the active discussion on electromagnetic principles were admirable contributions. Theoretical knowledge is a real asset to the art, and the large audiences at these meetings showed that engineers appreciate and approve papers which have a fundamental theoretical content.

In the realm of communication an unusually good group of papers was presented. The intricacies of cipher telegraph systems, the development of new equipment for recording and reproducing speech, technical developments in telephone circuits and an outstanding paper upon short radio waves in the upper atmosphere were presented. Many favorable comments were heard on the paper by W. G. Baker and C. W. Rice which delved into the realm of speculation in a way that compelled attention. The authors discussed a new method of exploration of the Kennelly-Heaviside layer which may lead to astonishing results in the art of atmospheric transmission of electricity.

While no epoch-making paper was presented at the meeting, there were several contributions of unusual value which marked progress and showed the way to further developments. The engineering job in the electrical industry is by no means completed, and the active, earnest group of Institute men showed by their papers and discussions that many long hours are spent behind the scenes by engineers in order that technical knowledge may sustain the financial and commercial structure that has been built upon it.

Making Performance Records Worth While

MANY operating companies have made detailed analyses of line performance with a view toward ascertaining causes of trouble and preventing their recurrence. At least one of the companies which have made such analyses has discontinued the practice, declaring that the information obtained permitted no definite conclusion of enough value to justify the work involved. On the other hand, other companies are continuing and additional companies are beginning the practice.

The company which has discontinued detailed analysis of line troubles declares that, however much vigilance is exercised, it is almost impossible to record more than the manifestation of the trouble. One man's guess is as good as another's when it comes to recording the cause, the company adds. For this reason it appears essential in keeping records to develop some procedure whereby what seems the nearest approach to the real cause of trouble can be isolated from other data and easily recorded. To facilitate this, it may be advisable to list on trouble reports the various possible detailed causes of trouble, so that the reporter can easily check the most likely cause and not merely give the first possible cause that may come to his mind. From past experience it also appears that the records should be reported by specific location (such as line, tower or pole number, phase, position in insulated string and so forth), so that subsequent classification, sub-classification and analysis can take into account exposure of line, equipment, operating conditions and so forth. Making trouble reports easy to fill in correctly and having the report made in form permitting subsequent classification are two essentials to effective analysis of performance. Finally, any reports which are worth making are worth careful analysis.

Is Better Home Lighting Really Coming?

SOME illumination specialists of pessimistic tendencies who have been working for better lighting many years without much apparent result in the residential field, although with considerable to show for their efforts in other fields, have declared that they hold home lighting to be nearly hopeless as far as improvement is concerned. They say that while illumination intensity has increased in the homes, as well as in other buildings, with the decreased cost, and while the light output of the commonly used sizes of lamps has increased, there is more injurious glare than ever from lamps on luminaires because shades are so often omitted or are inadequate when used. They also point to the large proportion of floor and table lamps, supposed to be for use in reading or close work, which give an inadequate intensity of light for those purposes or which are insufficiently shaded and therefore cause glare. While they commend the use of portable lamps for purely decorative purposes, provided there is proper shading, they remind us that it is nothing uncommon to go into a home where the decorative idea so overbalances utilitarian and hygienic considerations that there is no place where the light is adequate for reading and sewing, even where there has been a somewhat extravagant expenditure on lighting equipment.

It must be admitted that these pessimists have much evidence behind their gloomy views, but there are some encouraging signs nevertheless. Here are some of them: There has been a rapid increase in sales of the "bridge" type of floor lamp in the past five years. This bridge lamp, with its deep shade of parchment or silk, is nearly foolproof as regards possibilities for adjustment which may cause glare; and, the space under the shade being unobstructed, there is a well-lighted area there for reading and sewing that is not to be found with most other forms of portable lamps. It is one of the most satisfactory luminaires, combining usefulness and decoration, that have been introduced into the home in recent years. The demand has been such that quantity production on some of the simplest designs—but by no means the least artistic—has put retail prices on these lamps down to a point within reach of every home that can afford electric light. Then, too, there is the improvement in kitchen lighting that has been going on as a result of the power-company campaigns in the past three years, and this gain will continue and increase now that a real start has been made. The nation-wide home-lighting essay contest of 1924 has had its good effects, and its results will be felt for years to come as the children who took part in the contest put the ideas then gained in practice.

The prevalence of unshaded lamps on the fixtures being sold today for home lighting is, of course, unfortunate, and even where shades are being sold on such

fixtures the brightness of the shades is generally so great as to cause an entirely unnecessary amount of eye strain if the lighted fixture is faced for some time. The only optimistic view that can be taken of this phase of the situation as regards fixtures already sold and in use is that, except on special occasions in the home, these fixtures are not faced, since the users sit under them for close work or use localized light from portable lamps.

Another hopeful sign to which the optimists point is the recent appointment of a joint committee on lighting equipment by the Illuminating Engineering Society and the Association of Edison Illuminating Companies for the purpose of making a serious study of domestic lighting fixtures and developing with the help of the manufacturers a new assortment or arrangement which will provide a better distribution of light and better protection from glare. The hope embodied is that residence fixtures will be brought up to a stage of progress abreast of lamp development instead of lagging behind it from ten years to fifteen hundred as now. It is probably not necessary to call attention to specific examples of the practical results of this laggardness, but a common one is the purchase of a fixture to take four or five lamps of not over 40-watt size each, after which the thrifty householder leaves three or four sockets empty and puts in one big gas-filled tungsten lamp.

The amount of "passing the buck" in discussions of the home-lighting fixture situation would be amusing if it were not so serious. Leaving aside the special fixture designs which are of relatively small importance in the total fixture business, the commonest round of "buck passing" runs something like this: The fixture manufacturer says he has to produce designs which will sell to the dealer, the dealer knows he must confine his purchases to designs that will sell well to the buying public, and the public, which cannot afford special designs, says it cannot do otherwise than select from what the manufacturer and dealer have to offer. The fact is the responsibility for selection and design extends all the way around this circle, and it is only by bringing influence to bear all around that much can be accomplished. Concerted action by a sufficient number of manufacturers, of course, would force the issue, but such action is difficult to get except under the spur of economic necessity.

During the last years of the recent war the difficulties in getting glass caused a general movement among fixture manufacturers to put out designs without glass shades. This is one of the sources of present troubles. The style once started was not easily checked. Even after the economic pressure resulting from the scarcity of glass was removed, buying of this kind of fixtures continued, partly because of style inertia and partly because the omission of glass shades from a fixture permits the dealer to offer the purchaser a more imposing array of metalwork for a given amount of money, and the metalwork usually wins. This brings us to one of the basic facts of the luminaire industry, which is that it is engaged in producing "style" merchandise the purchasing or selection of which is largely done by women who buy in the main on style and appearance, just as they do in purchasing clothes, draperies and other "style" merchandise.

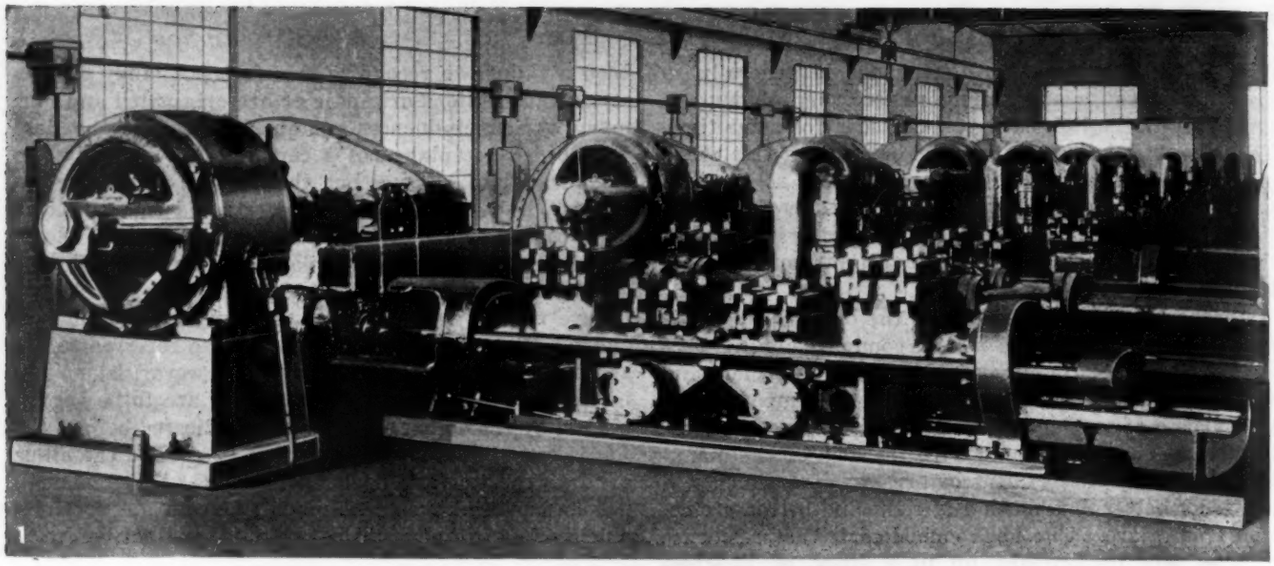
Perhaps the main reason why previous attempts of illuminating engineers to bring about reforms in home-lighting luminaires have met with so little success has been a failure to recognize this fact. A study of how styles and fashions originate or are originated and how many various influences combine to produce the final widespread acceptance of a certain style would be too complicated to pursue, but there are a few main influences that can and should be studied in connection with future attempts to improve luminaires for home lighting, if effort is to be placed where it will do the most good. Concerted action by a number of the larger fixture makers would have a very important influence, and for that reason the joint committee referred to has an important task assigned to it. However, let no one be deceived into the idea that results are to be accomplished by the action of a few. As indicated before, the job is essentially one of education all around the circle of designer, maker, dealer and user. When enough people are thinking and studying how to get comfortable lighting, results will be achieved, and not before.

A Practical Expression of Co-operation

THE dinner given last week in New York to honor J. Robert Crouse and to present the medal for co-operation given under the James H. McGraw award was a very practical expression of that spirit which has done so much to make the electrical industry great. A distinguished company, representing all the branches of the electrical industry, gathered to pay tribute to one who, above all else, has stood for co-ordinated purpose in the development of the electrical market. He is known as an enthusiast and an idealist, but he has applied his zeal to the promotion of co-operation for practical ends, and his work has shown results that have won the deep appreciation of all who have observed it.

With the background of many years of leadership in the old Incandescent Lamp Association and on the directorate of the Society for Electrical Development, the specific service for which the medal was awarded was in connection with the present establishment of the council of electrical refrigeration manufacture, in which the idea of co-operation for market building has been organized in rather novel form. The chief executives of the six manufacturers at present compose the council, under which operate a group of functional committees. The chief engineers, the works managers, the sales managers, advertising managers and service managers and other officials of the member companies are grouped together, each group to discuss its own functional problems. Each man contributes his individual experience to the common knowledge, out of which naturally develop constructive policies that avoid waste in many ways and add greatly to the creative influence of this young industry upon its market.

The testimony of such speakers as Henry L. Doherty, General Guy E. Tripp, W. W. Freeman and Mr. Crouse himself and the messages from Herbert Hoover and Owen D. Young gave fine evidence of the economic worth of such co-operative work in industry. The recognition of Mr. Crouse and the three men who received certificates of honorable mention for service in the advancement of co-operation in the electrical industry should give much encouragement to those other unselfish workers who, too often unseen and unsung, give so generously of their thought and time that electricity may bring into the lives of more and more people a constantly expanding service.



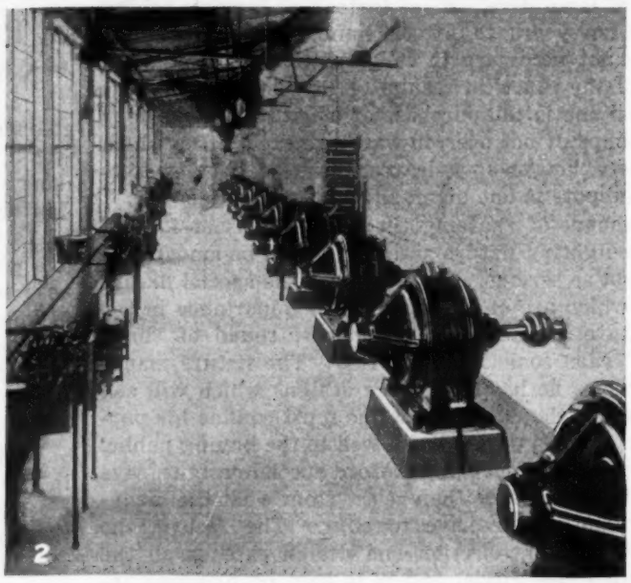
Electric Power in the Oil Fields

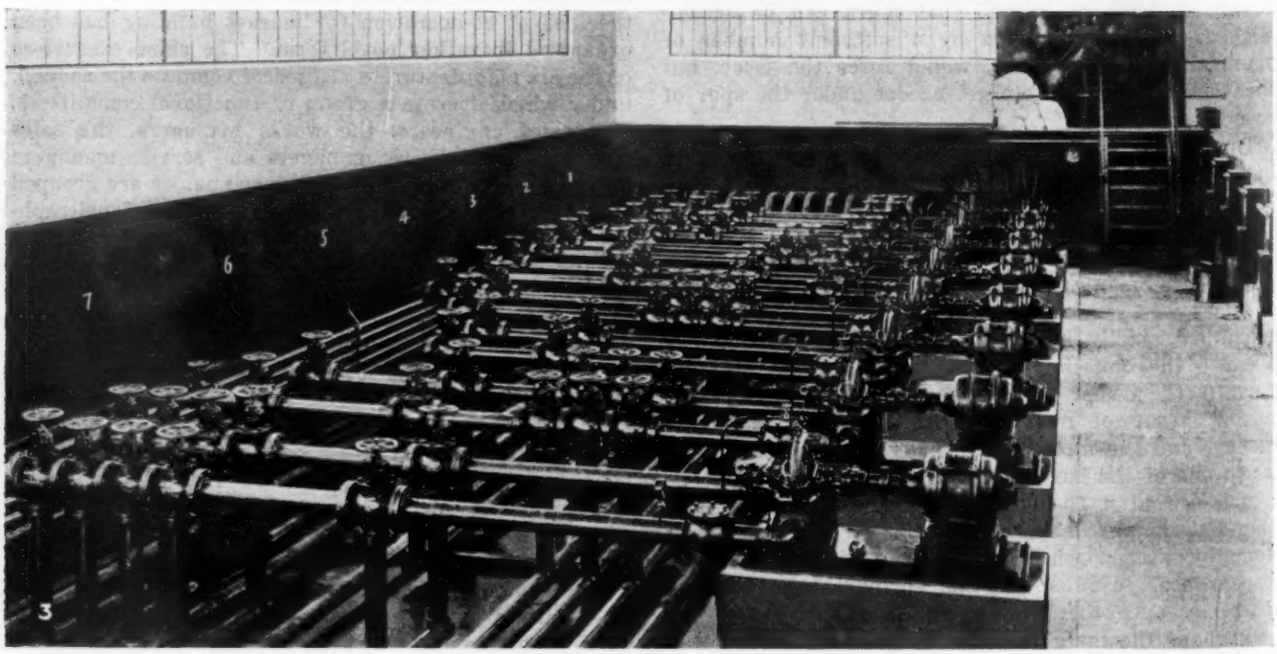
THE use of motor-driven centrifugal pumps for handling crude oil and its distillates is increasing in the fields of the mid-continent. Companies using this method of handling oil at refineries and pumping stations find it economical and efficient and the fact that motor sizes in the installations shown range from 10 hp. to 150 hp. speaks for the adaptability of motor drive to all types of pumping.

Fig. 1—Gould pumps designed for pressures as high as 750 lb. used in the still-charging house of the Texas Company plant at Port Arthur, Tex. The motors are rated at 150 hp.

Fig. 2—These 75-hp., 2,200-volt, two-phase, 60-cycle, 900-r.p.m. motors drive pumps used for loading oil for shipment from a refinery at Port Arthur, Tex.

Fig. 3—The Transcontinental Oil Company uses 10-hp. motors with centrifugal pumps to handle light distillates at a transfer pump house in Fort Worth, Tex.





Another Successful Institute Meeting

Midwinter Convention Held in New York Draws Large Attendance—Many Papers on Current Engineering Topics Presented and Discussed—Social Events and Inspection Trips—Detailed Report of the Technical Sessions

THE annual midwinter convention of the American Institute of Electrical Engineers was held in New York on Feb. 8 to Feb. 11. More than two thousand engineers attended the sessions to hear and discuss thirty-five technical papers. The midwinter meeting has come to be called the working convention, and the large attendance at an unusually good technical meeting showed that engineers are busy at many tasks. As President M. I. Pupin put it at the opening meeting: "Each year the engineers, like busy bees, meet to deposit the honey gathered during the year in order that all may partake of the good things collected."

This year the program was replete with excellent technical papers on current engineering developments. Transmission-system power limits, the characteristics of dielectrics, progress in the art of communication, new thoughts on old theories of electromagnetism and valuable papers on design and apparatus were included, and each session developed valuable discussions. No great outstanding technical development was described, but evidence of distinct progress in nearly all lines of engineering activity was presented and the results of studies made along various lines with more definiteness and understanding than was heretofore possible were put before the gathering.

The less severely technical features of the meeting were, as noted in last week's news report, a smoker on Tuesday night attended by more than a thousand engineers, a dinner-dance on Wednesday night at the Hotel Astor with seven hundred present and entertaining lectures on Thursday evening by Doctor Alexis Carrel and Major Allen Carpe. Inspection trips in and about New York were well attended by the visiting engineers and their guests.

Report of Technical Sessions

PRESIDENT PUPIN opened the first session in a few words, and Percy H. Thomas then presided while the subject of power system stability was discussed. In a good paper C. H. Nickle and F. L. Lawton used a miniature test system equivalent to a 150,000-kw., 220,000-volt system for stability tests and studies. They said that their tests showed static stability to be the criterion for system stability. Charging kva. was found to have a detrimental effect on stability, and the improvement in the speed and range of voltage-regulating apparatus offered good prospects for improving stability. The characteristics of terminal equipment have an important bearing on stability, they held, and automatic regulators, special exciters and fast relaying and breakers are essential aids to improving stability conditions.

The calculation of steady-state or static stability for a system was the basis of a splendid paper by Edith Clarke. Two methods were outlined and illustrated by examples. The equivalent-circuit method uses equivalent circuits as developed by Dr. Kennelly and replaces the line and terminal apparatus by equivalent-circuit constants. The circle-diagram method is used by testing the stability of the system at a given load graphically and finding that it is stable if there is assumed a slight voltage drop when the load is applied with excitation constant. The circle-diagram method is applicable to any kind of load, but at present the equivalent-circuit method has been applied only to synchronous-motor loads and constant-power-factor loads.

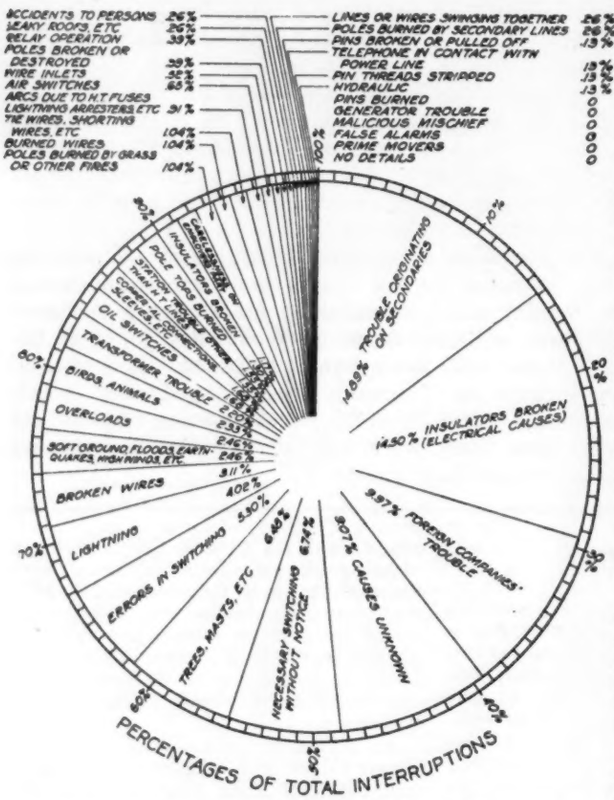
Stability tests on the Pacific Gas & Electric Company system were presented by Roy Wilkins. They showed that past disagreements on stability criteria were caused by differences in the relative importance assumed by different men for different circuit elements. More data are needed to give the final answer, but tests were sufficient to show very close agreement between test and calculated stability values, at least on maximum swings. Miniature systems are of little use in stability calculations of a quantitative character, as it is impossible as yet to evaluate all elements. The tests showed that the speed of relaying and switching are very important in stability studies, but that stored energy in governors is of little importance. The distribution of charging current has a decided influence on power limits, and under certain conditions phase balance and corona losses must be considered. The network impedance in value and characteristics has an important influence on stability limits.

Stability, according to the paper of R. D. Evans and C. F. Wagner, is the ability of a power system to remain in equilibrium and to regain equilibrium when disturbances occur. In most cases the transient conditions have most effect on stability. Methods for calculating transient stability were given in this paper. The authors said that the effect of governors is relatively unimportant except when there is a high reactance short circuit. The step-by-step method of calculation was found adequate to solve almost any stability problem. Methods given for increasing stability were increasing the number of circuits, lowering the frequency, increasing or maintaining terminal voltage by excitation methods, and using condensers and specially designed terminal equipment. The most severe condition was found to be a single-phase fault to ground followed by a clearing of this fault. The authors asserted that both transient and steady-state stability limits should be computed for a given system and that the answer to stability problems was to be found in getting good voltage regulation and a minimization of system disturbances.

An active discussion of the stability papers followed this paper. R. D. Evans complimented Miss Clark on the development of the equivalent-circuit calculating method and in particular on her solution for handling the phase angle between generators and load. He pointed out that fixed impedances could be used in calculations only if excitation was unchanged. H. H. Dewey traced the development of the stability problem and its solution. The great improvements, he said, have come through aids in excitation and regulation. Charging current has been found to be detrimental to a system, for it reduces the power limit. So many elements must be considered in any stability problem that miniature systems are good to secure only basic data and principles. More data on grounds and short circuits are needed to help solve the problem, and fast breaker operation and fast relaying are desirable aids. Grounds can be cleared, but phase-to-phase short circuits give great trouble.

H. K. Sells discussed stability from the standpoint of an operating engineer. He maintained that stability is a problem for low-voltage as well as high-voltage systems, but thought so many technical and practical operating elements are necessary to consider that any results must be qualitative. He thought technicalities had no place in the situation and that special equipment should not be considered unless it fitted into the general plan for system growth. C. A. Powell stated that

stability is associated with the rating of a line and that the rating varies as some function of the number of disturbances or the continuity of service attained. R. E. Doherty said that a complicated power system is not amenable to mathematical solution at present. On a specific system all doctors can diagnose the case, however, and agree upon what can be done and what ought to be done. C. L. Fortescue contended that static stability was one definite limit for any system and could be evaluated successfully. Transient stability is also a limit on a system, he said, and should be evaluated. It is not necessary or advisable to say that one limit is more important than another and if one limit is raised the other is generally raised also.



OPERATING SERVICE RECORD OF PACIFIC GAS & ELECTRIC COMPANY (WILKINS PAPER)

In closing, C. A. Nickle asserted that every changed condition on a system determined a new steady-state stability limit. Roy Wilkins said that while each 220-kv. line of the Pacific Gas & Electric system could carry 198,000 kw., it was planned to carry only 120,000 kw. on each circuit.

The last paper presented at the meeting covered the calculation of overcompounded transmission lines. H. B. Dwight, the author, showed that if the line is to have an increased voltage as the load increases and with compounding only at the generator, the resultant graph is a circle. If compounding is made at both generator and receiver ends, the graph is an ellipse.

L. F. Woodruff complimented the author and showed the usefulness of the method. He also showed how the ellipse could be transferred into a circle in order to make calculations more readily.

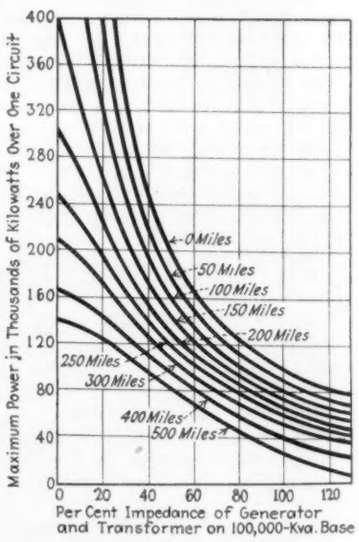
Dielectrics and Insulation

ON MONDAY evening several notable papers were given covering the subject of dielectrics with particular reference to a study of composite dielectrics. Dr. J. B. Whitehead in an admirable paper summed up the whole subject of dielectric absorption and the theories of dielectric behavior. He treated this topic in a historical manner and built up as a principal conclusion of his report that since in many cases the failure and life of insulation is certainly due to heat arising in the internal losses, and since these losses are probably directly related to the magnitude of the dielectric absorption, and since there are numerous methods available for the study of absorption, the most promising field for experimental work looking to improvement in all forms of composite insulation is that of dielectric absorption and its control.

The theories of dielectric absorption are as follows: (1) Those in which the fundamental magnetic equations are retained and the anomalies of dielectric behavior are attributed to anomalies of the structure of the dielectric medium; (2) those in which the departures from the fundamental laws are attributed to anomalies of dielectric displacements without reference to underlying mechanism; (3) those in which displacement and its anomalies are traced to the motion of electrons within the atom; (4) those which are based on anomalies of conductivity such as the free motion of ions, electrolytic dissociation, water in bulk or in capillary filaments. Almost without exception students of the theory of alternating dielectric loses agree in attributing these losses to the phenomenon of dielectric absorption. And although there are various theories as to the ultimate nature of absorption, they all conform sufficiently to the results of experiments to make it difficult to choose among them. Absorption itself cannot be controlled or predicted, and so it is not to be expected that definite expressions and constants may be laid down for the behavior under alternating electric intensities.

The author concluded that dielectric absorption is a conspicuous but obscure and little understood phenomenon. Only solids show the complete absorption phenomena on charge and discharge, and large changes in the absorption in solids may be caused by extremely small changes in composition. The charging absorption current merges into a final steady conduction current. Both are strongly increased by increase in temperature, the absorption finally disappearing or changing into conduction. The most satisfactory theory of dielectric absorption is that of Maxwell, although it is far from firmly established. The evidence is mostly indirect and it still needs quantitative proof. On the practical side, speaking generally, absorption is a conduction phenomenon, and therefore in all cases of varying applied electric force it occasions a current component in phase with that force. This means an energy loss in the dielectric. The two extremes of disadvantage of the presence of this loss are the danger it occasions to the life of high-voltage insulation and the attenuation and damping it causes in the high-frequency impulses and signals of wire and cable communication of telegraphy and telephony. In both cases the situation is aggravated by the fact that composite insulation is used in nearly all such cases and such insulation always possesses high absorption. More experimentation and study of the subject were urged.

A second valuable paper consisted of a study of ionization in paper-insulated cable by C. L. Dawes and P. L. Hoover. This research work led to the general conclusion that ionization in the dielectric of an air condenser increases its capacitance slightly at first and then rapidly as the electron is separated from the atom. The increase of power factor with increase in voltage gradient, with subsequent decrease of power factor, is due to the fact that the capacities of the solid dielectric is in series with ionized air spaces whose resistances are inversely as the current. Ionization by its bombarding action may destroy the baffling action of paper. Ionization may produce potential gradients tangential to the surface of the layer of paper, which in conjunction with the bombarding action may be the cause of the so-called "tree designs." The paper also covered a discussion of methods of measurement



LIMITS IN POWER TRANSMISSION (CLARK PAPER)

and a description of the equipment developed in the research.

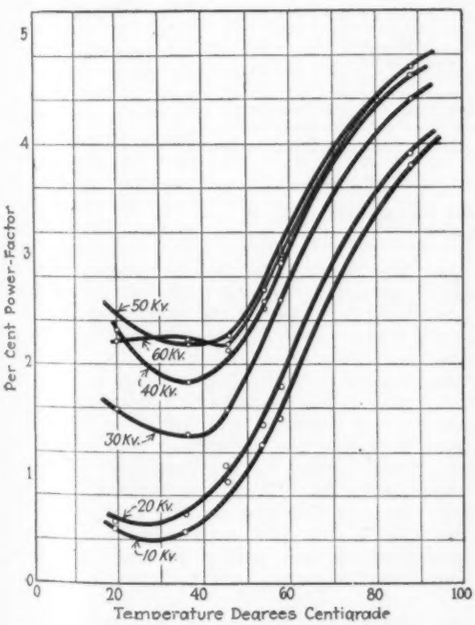
Another paper covering the theory of absorption in solid dielectrics was given by V. Karapetoff. The author developed certain general relations between the inccrease in electrical displacements in a solid dielectric and the time after the initial displacement, which occurs almost instantly after applying a constant direct-current voltage. The ultimate aim of the theory is to make it possible to correlate and mutually to check experimental data on absorption and dielectric loss and to predict these qualities where no test figures are available.

The discussion on these papers was very active and continued until a late hour. It served to bring out in an admirable way the different conceptions and theories outlined in the paper by Dr. Whitehead and the conflicting data and theories covering the general subject of ionization and dielectric absorption and their practical applications to cable breakdown phenomena. Progress in research was shown.

Protection and Control

THE Tuesday morning session dealt with protection, control and bus construction and was called to order by E. B. Meyer, who turned the meeting over to the direction of F. L. Hunt, acting in the absence of E. C. Stone, chairman of the committee on protective devices.

The first paper, written by J. M. Oliver and W. W. Eberhardt and presented by Mr. Eberhardt, related operating experiences with a Petersen earth coil on the Lock 12-Vida 44,000-volt system of the Alabama Power Company. This paper was concerned with experiences following those detailed in a previous paper read at the Pittsburgh convention in the spring of 1923. This experience covers eleven months, and the paper gives a compilation of system troubles showing that the coil functioned correctly in 94 out of 109 cases. Disturbances due to overvoltage can be eliminated by doing all switching with the coil cut out and the system neutral solidly grounded. It appears that the application of the coil is limited to systems of 66,000 volts or less.

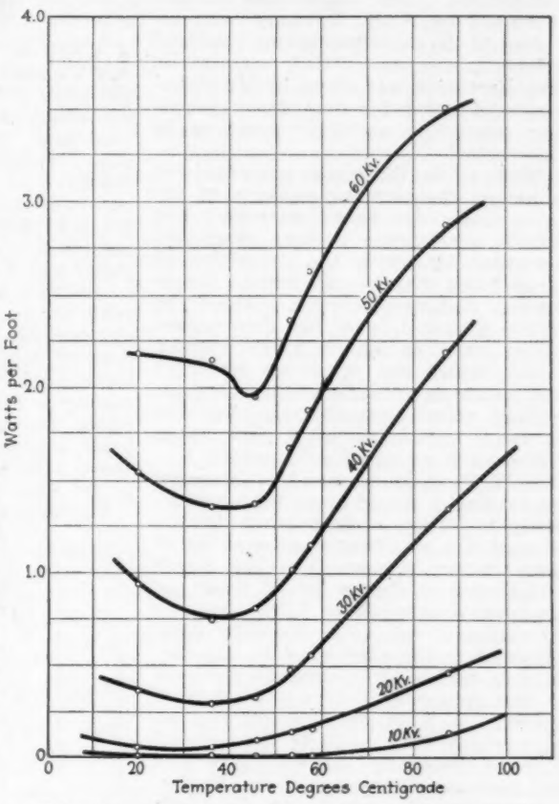


POWER FACTOR AS A FUNCTION OF TEMPERATURE AT VARIOUS VOLTAGES (HOOVER AND DAWES PAPER)

In discussion, L. P. Ferris brought up the point that the coil was overtuned about 26 per cent, which explained why the line tripped in some cases owing to imperfect operation of the coil. W. W. Lewis explained European practice with these coils.

The next paper, entitled "Theory of the Auto-Valve Lightning Arrester," by Joseph Slepian, was a discussion of the advantages of this type of arrester for high-voltage power systems. Mr. Slepian adverted to the explanation of cloud-potential discharges and stated that the gradient from a lightning-charged line to ground was about 100 kv. per foot of line height. The theory of the auto-valve arrester was explained in detail and reference was made to the early Thomas arrester, which operated on much the same principle. The principal discussion of this paper was by K. B. McEachron, who differed somewhat from Dr. Slepian in the comparison of the auto-valve and arc types and pointed out that the two do not give equal protection. Mr. McEachron illustrated on the blackboard some results of tests on the auto-valve arrester taken with a cathode-ray oscillograph and remarked that the rated gap drop of 280 volts could carry current in an appreciable amount across the gap. A criticism of the arrester was made by H. D. Wallau, who recounted experiences of his caused by the porcelain case breaking. In concluding the discussion, Dr. Slepian compared Mr. McEachron's investigations with Gulliver's excessively close-up views of the Brobdignagian court beauties and stated that the cathode-ray oscillograph compelled a revision of the usual concepts of short-time lapses. He admitted that there had been difficulties with the porcelain arrester case, but said that these were now overcome.

F. H. Kierstead presented the next paper, on "Current-Limiting Reactors with Fireproof Insulation on the Conductor." Tests were made on enamel, light asbestos and heavy asbestos insulation, and of the three the last only was successful. The failures of the others were due entirely to their inability to withstand mechanical injury caused by the force with which loose magnetic materials were jerked into the reactor. The paper was admirably illustrated by a motion picture which showed the effect of the reactor's magnetic field on iron or steel objects in or near it. In discussing the paper, S. I. Oesterreicher exhibited diverse objects which he had removed from reactors in investigating complaints of noise. Among these were bolts, nuts, nails, a file-cleaning brush and a tobacco box. V. M. Montsinger pointed out that the asbestos insulation should not have its fireproof quality vitiated by the presence of cotton fibers. A. E. Kennelly, in reference to the violent action of magnetic objects in the reactor field, observed that the violence of the action was affected by the non-uniform shape of the field.



WATTS PER FOOT AS A FUNCTION OF TEMPERATURE FOR NO. 00 SINGLE-CONDUCTOR CABLE (HOOVER AND DAWES PAPER)

A paper entitled "Temperature Rise and Losses in Solid Structural Steel Members Exposed to the Magnetic Field of Alternating-Current Conductors," by O. R. Schurig and H. P. Kuehni, was presented by Mr. Schurig. This paper was based on data derived from tests on various structural-steel shapes arranged in different forms and positions in the neighborhood of buses carrying an electric current. One of the general conclusions of the test was that the temperature of affected structural-steel pieces varied with the 1.7 power of the current, and that structural members paralleling the bus had a temperature rise of 30 to 80 per cent less than those crossing the bus at right angles. The results obtained from these experiments were found to be in close agreement with other investigators' theoretical results relating to effects and losses in solid iron.

Discussion on this paper was opened by H. C. Forbes, who referred to tests of the same nature made by the New York Edison Company. The general results of these tests was that reasonable caution should be used in design and that no structural member should be located within 2½ ft. of high-current conductors. The paper was further discussed by A. E. Kennelly, who referred to the calculations employed and generally commended their correctness. The discussion was closed by Mr. Schurig, who asked for data from operating companies on their practices in this regard.

Titus G. Le Clair next presented his paper on the carrying capacity of 60-cycle buses for heavy current. For simple geometrical designs there are formulas by which the capacities of large buses may be calculated. These simple designs, however, cannot be easily mounted, and for this reason resort must be had to more complex styles, which are easier to construct but much more difficult to calculate. Curves were presented showing the carrying capacities of a few types which were proposed as standard.

F. W. Peek, Jr., opened the discussion by reading a paper prepared by H. B. Dwight. This, among other things, suggested a modification of a series of data curves presented in the paper which showed the rating of buses on grouped phases above 3,000 amp. at 60 cycles. Next A. E. Kennelly drew attention to the edge effect in flat conductors, which added about 25 per cent to the apparent resistance in thinner shapes. O. S. Major referred to some tests which were made by the General Electric Company several years ago and took some exception to the 40-deg. temperature rise which Mr. Le Clair had declared permissible. E. R. Hanna brought up the point of interlacing buses in order to obviate some of the deleterious effects. Closing the discussion, Mr. Le Clair stated that interlacing was not always practicable and in reference to Dr. Kennelly's remark said that to his mind the edge effect was only another way of stating skin effect.

The closing paper of the morning session, entitled "Supervisory Systems for Electric Power Apparatus," by Chester Lichtenberg, dwelt on the distinction between remote-control systems and supervisory systems, following this with historical matter on the development of these systems and then a description of various types of systems. This was the first paper on the subject ever presented before the Institute. A motion picture was shown emphasizing the difference between the operation of a supervisory system, with its rapid response to the system operated, and the ordinary telephone connection.

Pictures were also shown of the supervisory system in operation in the Malden Electric Company's plant, and the circuits were explained by animated line drawings which built up the essential parts of the system on the screen. Following the paper, C. D. Stewart gave some interesting information on the increasing use of supervisory systems. He said that they had given successful service on the equivalent of 2,500 oil circuit breakers—that is to say, General Electric systems alone—that by the end of this year will be in use in 22 additional stations, and that a carrier selector supervisory system to take care of eight stations will be installed. R. J. Wensley then referred to various Westinghouse systems, particularly to that installed on the Staten Island Railroad. He also defended the use of telephone relays, which had been somewhat decried in the original paper.

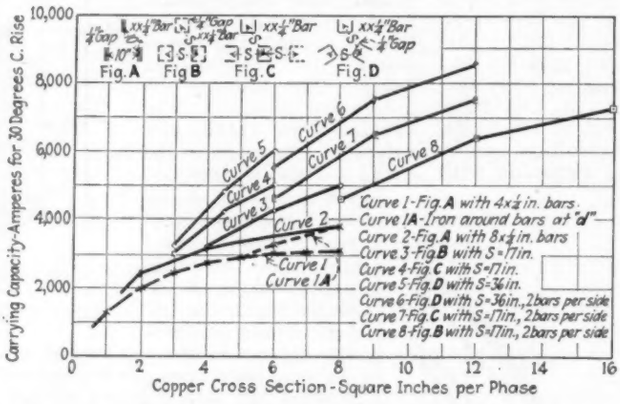
Machine Losses and Ventilation

ONE of the parallel sessions on Tuesday afternoon was devoted to the work of the committee on electrical machinery and was in charge of the chairman, H. M. Hobart. The first paper, entitled "A Contribution to the Research on the Experimental Determination of the Losses in Alternators," by Edouard Roth of Belfort, France, was presented by E. H. Freiburghouse. This paper was intended as a suggestion for a revision of the existing Institute rules for the determination of losses in alternators. The paper contained records of experimental researches which serve, on the one hand, as a basis of discussion of the theoretical considerations which are developed and, on the other hand, to compare the actual losses with those obtained by the methods given in the rules at present in force.

The discussions which followed this paper went off at a tangent from the considerations presented and were confined almost entirely to the determination of alternator losses by means of temperature difference between incoming and outgoing ventilating air. In his remarks on this subject W. F. Dawson stated that the actual losses under operating load conditions were always less than the losses obtained by short-circuit tests. As an instance of the agreement between factory and operating tests he referred to a particular case of a generator which was tested by the air method in the factory and showed losses of 279 kw. and which in the operating condition, after its acceptance by the customer, showed a loss of 270 kw.

B. L. Barnes next described loss tests made on alternators in the Queenston plant of the Hydro-Electric Power Commission of Ontario. These tests were made by the air method. At the conclusion of his discussion he presented a method suggested by P. A. Borden which obviates the necessity for temperature measurement of the air. This method consists of balancing the resistances of grids inserted in the incoming and outgoing passages by means of a Wheatstone bridge, and it has operated very successfully in the laboratory. W. J. Foster said that both Steinmetz and Lamme had considered short-circuit conditions as the worst and had taken one-third of the short-circuit loss as the load loss. Later experience had shown that this proportion was too small for general application on account of the differences between types of generators. The magnitude of the losses was also affected by binding-band effect and by the design of the heads of the stators and rotors of the machines. He further gave it as his opinion that the air method for the determination of losses was the only feasible one, but that allowance had to be made for radiation losses.

C. J. Fechheimer doubted the practicability of the method suggested in the paper and inquired how it took account of tooth losses by cross-magnetization. He remarked that the thermo method requires care and is not always accurate, but that this consideration would be gone into in greater detail at a later convention. There is no doubt, he thought, that present methods can be improved upon. In closing the discussion for Mr. Roth, Mr. Freiburghouse stated the author agreed with the air method as a test against the calculated losses.


Carrying Capacity-Amperes for 30 Degrees C. Rise
Copper Cross Section-Square Inches per Phase
Fig. A
Fig. B
Fig. C
Fig. D
Curve 1-Fig. A with 4x½ in. bars.
Curve 1A-Iron around bars at "d"
Curve 2-Fig. A with 8x½ in. bars
Curve 3-Fig. B with S=7in.
Curve 4-Fig. C with S=7in.
Curve 5-Fig. D with S=3½in.
Curve 6-Fig. D with S=3½in., 2bars per side
Curve 7-Fig. C with S=7in., 2bars per side
Curve 8-Fig. B with S=7in., 2bars per side

RATINGS OF BUSES ON GROUPED PHASES ABOVE 3,000 AMP. AT 60 CYCLES (LE CLAIR PAPER)

Thomas Spooner next read his paper on "No-Load Copper Eddy-Current Losses." These losses occur in salient-pole machines, alternating-current and direct-current, and in induction motors, and are sometimes very considerable factors in the total loss of these machines. They are caused by slot leakage flux produced by the main flux. Some of the consequences of this analysis are rather unexpected where the frequencies are sufficiently high to produce large skin effect. For instance, laminating the copper may produce increased or decreased losses, depending upon the conditions. In discussion of this paper W. J. Foster suggested that core-loss tests on the machine be made before it is wound, and he took exception to the method suggested in that it took no account of the fringe flux at machine heads.

The third paper, on "The Mechanical Force Between Electric Circuits," by R. E. Doherty and R. H. Park, was presented by Mr. Doherty. A general

equation was developed in this paper for the mechanical force exerted by a system of n electric circuits upon any part of that system. The results of this study are preliminary to an investigation of the forces existing in synchronous machines under the conditions of short circuit, which will be treated in a later paper. The paper was elaborated in the discussion which followed by Mr. Park, who showed some slides illustrating particular cases.

The session was closed by a paper on the "Ventilation of Turbo-Alternators," referring to the multiple-pass radial system, by C. J. Fechheimer and G. W. Penney. The first half of the paper was read by Mr. Fechheimer and the latter half by Mr. Penney. It was early discovered in the investigation that the effect of the rotation of a machine could be neglected. The experimental work was carried out on stationary models, which were built up of series of square brass tubes arranged to simulate the air passages in the machine. The losses in the intake and discharge passages were separated into component parts, which permitted of statements of equations in comparatively simple expressions. These were then combined to obtain a final solution. The equation of the intake side was readily integrated, but the one for the discharge side required the use of approximations. With the aid of these final equations the total volume of air and its distribution can be calculated for a given pressure drop. The equations were checked for accuracy by tests made on the tubes, on the turbo model of 1922 and 1923 and with those on an actual machine. The agreement in total volumes was very close.

The discussion of this paper was confined to some written remarks by S. L. Henderson which were read by Joseph Slepian. It was stated that the results obtained from these investigations were used in the actual design of an alternator, with the result that the machine was considerably shortened.

Developments in Communication

IN THE communication session some splendid papers were presented dealing with a diversity of topics. The development of the loaded line was described in a paper by Thomas Shaw and William Fondiller. The authors developed an equation for a general circuit with loading coils which takes care of the location of coils and the current values of the circuit. Special applications of loading coils were discussed fully.

In the discussion which followed Dr. F. B. Jewett presented strikingly the great progress made in communication by the use of carrier and multiplex systems. It is now possible to transmit an enormous mass of material at a very rapid rate with a minimum of physical lines. Dr. M. I. Pupin said that he first used loading in 1898 and outlined the theory of filters in 1900. He recalled that toroidal loading was slow to be accepted, but, once accepted, was developed and perfected at a rapid rate. The use of the repeater as a supplementary device with the loading coil has worked out splendidly, he said. William Fondiller asserted that it took much ingenious development to use loading coils and repeaters on a circuit and the refinements in measurements required the development of the shielded balance, the shielded impedance and the capacity bridge.

Cipher telegraphic systems were discussed in a paper by G. S. Vernam. The method is considered undecipherable without the key and can be adapted to several types of machines. As usually applied it is for standard printing telegraph machines and utilizes a key with a substitution cipher alphabet which involves no repetition. By means of this system messages may be enciphered and deciphered when sent or received with great readiness.

One of the most far-reaching and stimulating papers presented before the Institute in years was given by W. G. Baker and C. W. Rice. This dealt with short-wave radio transmission phenomena and incidentally attempted to explain these phenomena by studying the Kennelly-Heaviside layer effects of the upper atmosphere. Transmission of 15-m. to 60-m. waves shows many peculiarities. The ground waves may focus at a certain point and then disappear at a distance of 70 miles from the sending station. Then, at 250 miles distant, signals called the sky signals may again appear and again disappear, and perhaps at 7,000 miles signals again will be heard loudly. Moreover, summer and winter conditions affect the step distances markedly. Apparently waves are reflected by electronic effects in the Kennelly-Heaviside layer. Ionization of electrons excited by energy of the sun appears to occur in this layer, and this affects the radio waves and apparently even increases the propagation velocity, so that it exceeds that of light. Waves start out at different angles, and at certain critical angles they may go to earth, to the Kennelly-Heaviside layer or into space. Those going into the Kennelly-Heaviside layer are affected by refraction, reflection and local polarization by electronic ionization.

Dr. A. E. Kennelly discussed the paper and complimented the authors. He said effects on the upper atmosphere, say 30 km. above earth, cause astonishing phenomena with short waves. The nature of the upper layer is still undeciphered, but opinions may be formed and radio observations are beginning to give valuable data. It is yet early to form fixed opinions or make conclusions, but there must be refraction, local polarization and perhaps reflection in this layer, and these may occur simultaneously. A knowledge of this layer will be valuable in radio and in weather forecasting.

An excellent paper by J. P. Maxfield and H. C. Harrison dealt with the recording and reproducing of speech. It described the newly developed phonograph, and a demonstration of the equipment was very convincing. The authors found the exponential horn most effective for reproduction and they said radio had introduced new ideas for the recording of sound and the reproduction of this sound. The sound is recorded on a waxed blank which is cut irregularly corresponding to sound-wave variations. The sound-wave energy is amplified to actuate this cutting knife. No amplification is used in the reproducing equipment. The record covers a range from 60 to 5,500 or 6,000 cycles and the commercial instruments are for a frequency of from 100 to 5,000 cycles.

Machine Heating and Characteristics

THE second session on electrical machinery, held Wednesday morning, was also presided over by Chairman Hobart. The first paper, entitled, "Parameters of Heating Curves of Electrical Machinery," was presented by Prof. V. Karapetoff. It was pointed out in this paper that an electrical machine cannot be treated as a single mass of metal and that, therefore, its temperature rise does not follow the simple time-temperature curve which is usually considered exponential. Ordinary studies of a machine do not take into account the separate masses of the windings of both stator and rotor and the iron of these two parts. The differential equations of heat flow in such a combination of bodies were established and solved.

G. E. Luke stated that he had worked out the temperature curves for one machine in which he treated the mass as of three parts and used these calculations in design. He further stated that these studies can be used for conductor calculations. F. H. Kierstead complimented Professor Karapetoff on his paper, remarking on its clarity and ease of understanding. He suggested that other papers could profit by this quality. The similarity of Karapetoff's results with the original studies in this matter made by Goldschmidt was remarked in a comparison by W. F. Dawson. C. J. Fechheimer pointed out that the method does not include consideration of longitudinal heat flow. He said further that he had tried to derive these equations eight or ten years ago and got lost in the calculations. A. E. Kennelly complimented Karapetoff on his paper and remarked that nature appears to love exponential curves. He suggested, however, the use of binary time-constant curves instead of exponential ones as a simplification of the method for actual practice.

The next paper, on the "Rating of Electrical Machinery as Affected by Altitude," was presented by C. J. Fechheimer. Ignoring differences in ambient temperatures, the effect of altitude may, he said, be considered from two standpoints—(a) the change in temperature rise, (b) the change in rating. The application of both were considered and equations were solved in both ways. The difference in ambient temperature at sea level and at altitudes was also taken into consideration in other equations.

P. L. Alger observed that the reduction in temperature at high altitude

usually balances the decrease in atmospheric density and that for practical purposes it may be considered that the machine is not changed by altitude. G. E. Luke next pointed out that the cases exceeding the 1,000-meter altitude standard of the A.I.E.E. included only about 2 per cent of the machines manufactured and that the application of these studies was advisable only in special cases. He said he did not believe the rule should be enlarged to include these. W. F. Dawson contended that the effects of temperatures at high altitude are overstressed. He mentioned the possibility of the use of supercharger to compensate for tenuity of the air at higher altitudes.

BAND LOSSES

Thomas Spooner then presented a paper on "Motor-Band Losses." It was shown that railway motor-band losses are of appreciable magnitude, sometimes sufficiently large to be detrimental to the cooling of the machine. By tests of a small machine as checked against those of a large one. The band losses are found to vary according to the 1.7 power of the frequency and to the 1.35 to the 1.8 power of the induction, depending on the width and type of the band. With average bands about 16 per cent of the losses are due to the tangential flux in the band. The differences between insulated and uninsulated bands were brought out.

E. S. Lincoln instanced a case of trouble caused by a hot band which refused to hold solder. The trouble was corrected by holding the band with tie bars placed at intervals around the periphery of the armature. These tie pieces were so spaced that they passed under like poles of the field at the same time, thus causing the short-circuited band currents to neutralize each other.

MOTOR CHARACTERISTICS

The last paper of the session was entitled "Starting Characteristics and Control of Polyphase Squirrel-Cage Induction Motors," and was presented by Horace M. Norman. This paper was chiefly concerned with the losses in starting, stopping and plugging controls of induction motors. The subject of static loss is of interest, Mr. Norman held, from the control standpoint as, for instance, in the application of autotransformers for starting purposes, or where an external resistance is inserted in the primary as is done in the control of elevator motors. There are many cases where a motor has already been designed and tested and is about to be applied on a given job where the cycle of operation is known and includes either starting and stopping or plugging. In such an event, instead of working with the various test values, it is much more convenient and accurate to work on such values as starting torque, maximum torque, slip at full load, locked current and primary resistance.

A short-cut method has been devised for the use of these factors. In discussing this paper Prof. B. F. Bailey gave a formula for motor efficiency in terms of torque, speed and power consumption and illustrated its application to specific problems.

Laws of Electromagnetism

PROBLEMS in magnetism and electrodynamics occupied the morning session Thursday. J. H. Morecroft, chairman committee on electrophysics, presided. Dr. C. O. Mailloux abstracted a paper on the "Calculation of Magnetic Attraction," by Th. Lehmann, consulting engineer of Urmatt, France. The author described a method of surveying and measuring the magnetic force in an airgap by applying the theory of the potential function. In this method the magnetic field is decomposed into elemental tubes of magnetic force whose envelopes inclose spaces in which the magnetic density is constant. This facilitates calculations.

In discussing the paper, Dr. Joseph Slepian emphasized the extensive use of mechanical analogies in Maxwell's work and touched upon difficulties experienced in trying to derive the formulas used by the author.

"The Magnetic Hysteresis Curve," by Hans Lippelt, was the subject of a paper analyzing hysteretic phenomena. The author introduced the conception of a reactive component and a dissipative component of the counteracting force acting when magnetic material is subjected to a magnetizing force. Equations and curves were presented showing the variations of these components with the magnetizing force. In the discussion the point was made that near the point of saturation magnetization curves do not follow the laws defined by the author and other workers in this field.

Seeking a basic unit for mathematical treatment of a single conductor's electrodynamic properties, Dr. Carl Hering abstracted a paper in which he investigated the properties of a unit length of wire far removed from all other circuits and deducted a constant for the stored energy from a current in such a length. Several speakers took issue with the paper, contending that the author's reasoning was inconsistent with the classical electromagnetic theory. In rebuttal, Dr. Hering declared that Kelvin's law applies to his problem, that self-induction formulas are approximate in the opinions of many, and that many of his critics based their arguments on the proximity of neighboring conductors—a point entirely aside from his own fundamental assumption.

The final paper of the morning was "Heaviside's Proof of His Expansion Theorem," by M. S. Vallarta. The author reconstructed this proof from scattered material in Heaviside's "Electrical Papers."

Measurements and New Devices

FIVE papers on measurement, testing and design were presented at the closing technical session Thursday afternoon under the auspices of the committee on instruments and measurements. W. A. Del Mar presided in the absence of Chairman A. E. Knowlton. The opening paper, "A New Wave-Shape Factor and Meter," by L. A. Doggett, J. W. Hein and M. W. White, described a meter dependent upon the properties of a star-connected circuit consisting of two voltmeters and a variable condenser, to be used as a convenient portable supplement to the oscillograph.

In the discussion the authors were highly complimented upon their contribution to the art of electrical measurement. Some questions as to adjustment and accuracy especially in unbalanced circuits were raised The possible improvement of the accuracy of oscillographs through the use of resonant circuits was suggested, with the idea of separating the fundamental and the harmonics more effectively. C. W. Bates emphasized the importance of using first-class instruments in the wavemeter and outlined the magnitude of errors which may at times occur from unbalanced circuits. He stated that an average voltage unbalance as low as 1 per cent may produce errors of 2 to 3 per cent. In closing, Mr. Doggett maintained that the method embodied in the meter is not subject to any great error up to 2 per cent voltage unbalance.

J. Ormondroyd then abstracted a paper on "The Use of Vibration Instruments on Electrical Machinery." This emphasized the advantages of mechanical instruments of the seismographic type for studying floor vibrations and vibrations in electric locomotives. Equipment for prime-mover study was also described. W. B. Creagmile pointed out the freedom of the vibrating-reed tachometer from the vibrations of machines under test.

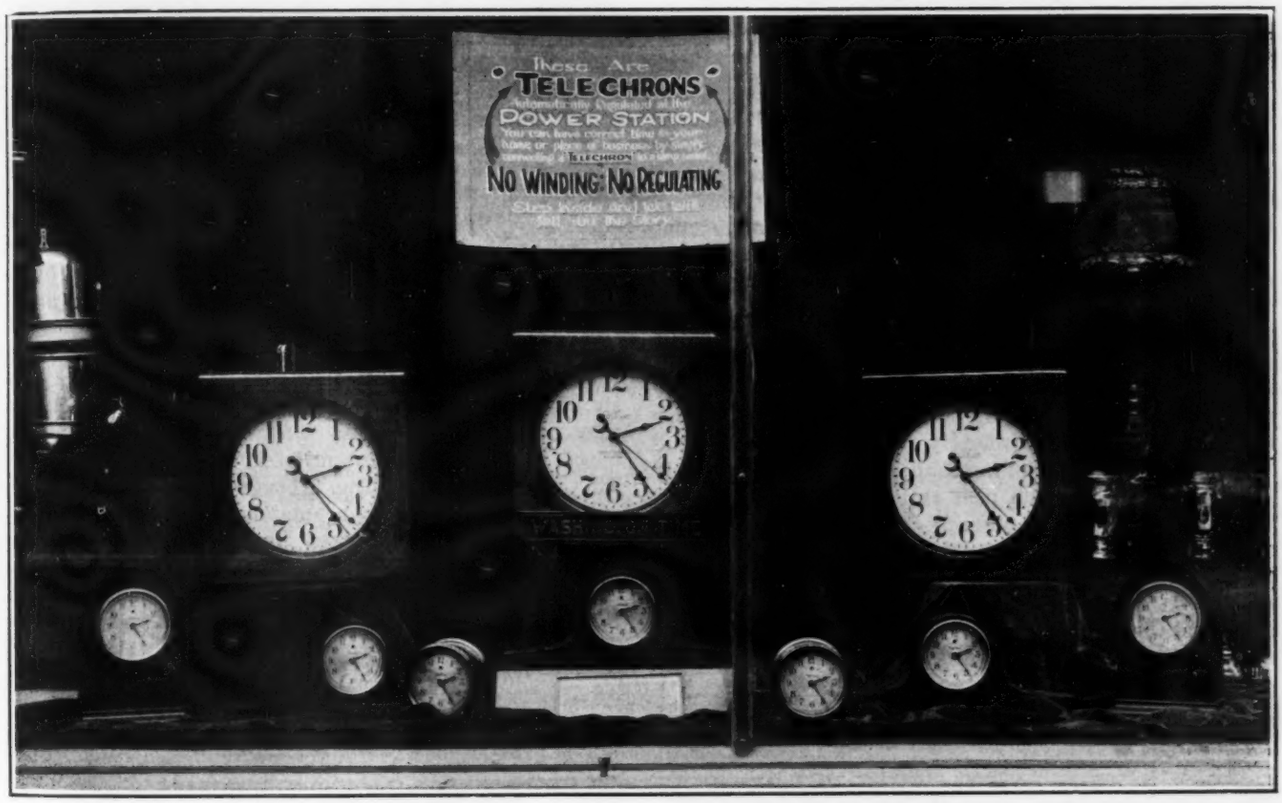
The advantages of high-frequency voltage tests of insulation between the turns of windings were set forth in a paper by J. L. Rylander. This frequency is produced by a damped oscillating discharge from a condenser, and as a shop method its application has been very effective. V. M. Montsinger described a shop test used at the General Electric works in Pittsfield, Mass., to detect poor insulation in coil turns by telephonic indications in connection with the application of oscillations produced by the quenched gap. G. E. Luke pointed out that insufficient drying of impregnating compounds has been a cause of failure of insulation between turns. In closing the discussion the author favored the use of rotating disks in producing arcing for high-frequency applications and direct application to the coil in preference to induced frequencies.

"The Cross-Field Theory of Alternating-Current Machines" was the subject of a paper by H. R. West which pointed out the convenience of this method in calculating and analyzing the performance of a single-phase motor and a repulsion motor. In the discussion the revolving-field theory was stoutly defended.

A. D. Keene and G. E. Luke presented the final paper of the session, upon "The Rating of Heating Elements for Electric Furnaces." The authors studied the problems of radiation and absorption, location, shape, spacing and shielding of elements, with examples from commercial practice.

Correct Time— A New Central-Station Service

Experience of the Philadelphia Electric Company in Merchandising Secondary Telechron Clocks as a Correct-Time Service — Other Apparatus Now Perfected for Use on the System—More Companies Entering the Field



DISPLAY OF GENERAL SERVICE CLOCKS OPERATING ON CENTRAL-STATION FREQUENCY

THE city of Philadelphia has recently witnessed something new under the sun—a central-station company inaugurating the first campaign for the sale of correct time—and many householders of that so-called conservative old community are buying clocks from the electric power company to plug into a handy receptacle or socket and end forevermore all doubt as to whether or not it is time for the breadwinner to start out in pursuit of more bread, or for the children to set out for school, or for the woman of the house to call a taxi and go to the party. The Philadelphia Electric Company about a year ago installed in its power houses the Telechron master clock method of frequency regulation, manufactured by the Warren Clock Company of Ashland, Mass., and became very much interested in the practical opportunity it offered for developing the use of Telechron secondary clocks in the homes, offices, stores and factories of its customers and thus adding a service of correct time to the other benefits of electric service that have grouped themselves under the three heads of light, heat and power.

The value of such service is obvious, for the use of clocks is universal. Every man, woman and child must consult the clock on numerous occasions every day. The catching of trains and the keeping of engagements are dependent upon a knowledge of correct time. Yet there is no absolutely reliable source of time available. Watches and clocks run fast and slow, and now that it is no longer possible to call the telephone operator and ask for the correct time, confidence in clocks is maintained only by perpetual vigilance and continual comparison of watches with Western Union clocks and then checking the watch with the clock at home. For the central station to offer a service of correct time, therefore, is an extremely popular innovation that satisfies a very practical household need and should be of very great value to the central station from the standpoint of public relations, without regard to the income for current consumption or the merchandising profit that the clocks may bring.

The master clock was installed on the Philadelphia Electric Company's system in June, 1920. In May,

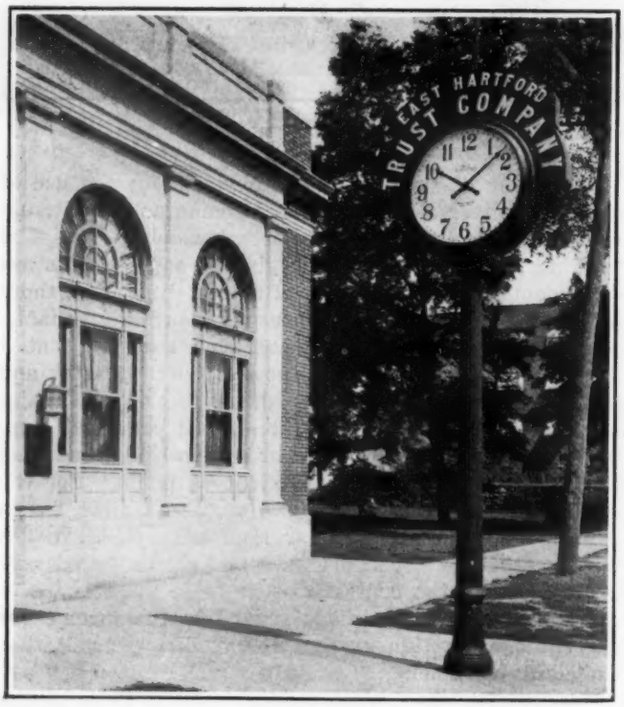
1925, a few secondary clocks were put on display in the company sales room and a display of Telechrons was featured in one of the show windows. A number of clocks with sweep second hands were arranged so that the big second hands swept slowly around the dials in perfect harmony. The novelty of a lot of clocks absolutely alike to the second and these sweep hands revolving absolutely together proved a strong attraction. Crowds stood and watched and for two weeks this display brought an average of 200 persons into the electric shop daily to ask about them. In June, 1925, part of the company's regular appliance advertising broadside was devoted to these clocks. About 63 per cent of those who came into the store to ask about them and those who responded to the broadside have bought clocks.

More Outlets
MAKE MORE CONVENIENT HOMES
Ask your local electrical contractor or any of our solicitors for suggestions
The United Electric Light & Power Co.

ADVERTISING USE OF A TELECHRON

NEW DEVELOPMENTS

It is astonishing how very few central-station executives realize the extent to which the idea of utilizing central-station current for time-keeping purposes has been developed. In 1917 and 1918, when the master-clock method of regulating frequency was introduced, the impression was general that its chief importance was from a meter standpoint; that it was a device to eliminate complaints from customers because of poor frequency regulation. During the next four or five years the manufacturer was kept busy supplying the demands for synchronous motor movements for use in recording instruments of various types, and there are many thousands of motors now used for this purpose because they give an absolutely synchronized record and winding, regulating, oiling and cleaning are entirely eliminated. Within the past two or three years, however, there has been a marked change, and the demand for the Telechron is now chiefly for use in secondary clocks and other devices outside of recording instruments; these clocks and devices are used not by the central station but by central-station customers. During this time a number of other very interesting and important developments have been made. Chief among these has been the development of the secondary clocks, thousands of which are now used by homes, offices, schools, factories and hotels.



SIDEWALK CLOCK OPERATED ON SYSTEM FREQUENCY

The importance of these clocks from the point of view of energy sales is not impressive when a single clock is considered, but when figured on the basis of the need for correct time and the profitable extent of the eventual market, the idea offers something extremely worth while.

The current consumption of the individual clock is very low, but the annual consumption amounts to a significant item from a load standpoint. The clocks, as they have been previously built, are rated at 2 watts, hence the annual consumption amounts to 17½ kw.-hr. This, compared with the average annual consumption of some other well-known appliances, is very favorable. The National Electric Light Association has found the average annual consumption of a washing machine is 12.9 kw.-hr., for a toaster 30 kw.-hr., for a curling iron 1 kw.-hr. In cities like Boston, where several thousand secondary clocks are connected to the central-station system, it is evident that there is an appreciable revenue from this source. The load is also of a very desirable character, because it is even and continuous throughout the 24-hour period and approximately 80 per cent to 85 per cent is off-peak. Moreover, this is not the maximum load that may be expected.

This winter or early in the spring there will be placed in production a new type of Telechron by which central-station energy will also be used to illuminate the dial of the clock. This will be accomplished by means of a small lamp placed behind the dial from which the light is reflected around the outside of the dial, giving it very even and very satisfactory illumination. The clock can be easily read from a distance of 18 or 20 ft. by the average person, which compares with a few feet at which a radium dial is visible. Furthermore, the light is not strong enough to be objectionable in a bedroom. This clock will consume about 50 kw.-hr. per annum, and it is believed it will prove to be an appealing unit after it is placed in production.

TIME SWITCH FOR SIGNS

Another important development is an automatic time switch. In this switch the synchronous motor has replaced the familiar spring movement. The application of the motor to the time switch means that a great many outdoor signs, store windows and the like, which it has previously been impractical to illuminate, can now be lighted, with considerable increase in revenue to the

central stations. The motor-driven time switch, because of its no-winding characteristics, can be installed in out-of-the-way places along boulevards, railroads, etc., to illuminate billboards, where the necessity of winding old-style time switches prohibited the use of illumination at night. In addition, the fact that the motor movement has many times the power of a spring movement, together with the fact that there are no delicate escapements to contend with, means that practically all the attention required for maintenance has been eliminated. The switch is inclosed in a moisture-proof, dust-proof case, so that it is admirable for this purpose.

It is readily apparent, therefore, that although the switch itself is not a great load-building factor, indirectly it can benefit the central station to a very large extent by increasing the outside illumination. On the Arrow Collar sign in Times Square, New York, where a large sign and secondary clock have been combined, the annual consumption amounts to 175,800 kw.-hr. for 2,200 5-watt lamps.

The list of central stations where Telechron master clocks are in control is a long one and numbers a great many of the most prominent utility companies in the country. It is an interesting fact also that a number of systems are supplied with Telechron regulation through interconnection, even though no master clock is installed in their own plants. One large superpower system in the Southeast, comprising 1,500 miles of 110,000-volt transmission lines, is said to be all regulated from one master clock.

In the beginning it was natural that some companies should fear that the use of secondary clocks in the homes of consumers would involve complaints either because there would be interruptions in current or because the frequency would not be maintained at all times due to conditions beyond the control of the central station. However, reports from companies on the line of which many Telechron secondary clocks are operating show that this is not so. The following letter from Miss S. M. Sheridan, sales manager of the Detroit Edison Company, is a good example. Miss Sheridan writes:

"We have no way of knowing how many of these Telechrons are on our lines, but we think we have a hundred at least, and we have never had any complaint. The fact is that our continuity of service is very high and I doubt that the customers would have any occasion to make such complaints. When inquiry is made of us regarding the use of the clock we do, however, warn the prospective user that the service is liable to interruption and he will have to remember to adjust his clock when he notices the signal up or when he knows the service has been interrupted. From my personal experience with the clock, I believe that it would be a factor in building good will."*

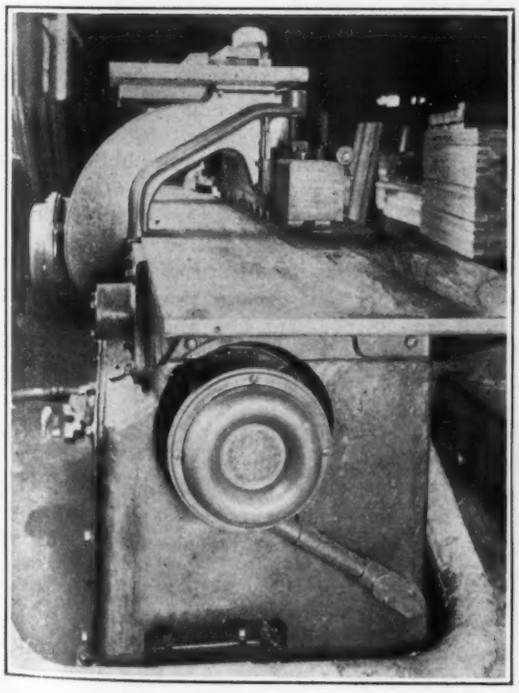
The sale of secondary clocks by companies where systems are regulated by Telechron master clocks has not as yet been extensive. There apparently has been a disposition to try out the system for some time before going to the public with this new service of correct time. Five important companies are said to be now planning to go ahead, however, and are preparing to organize selling campaigns this winter.

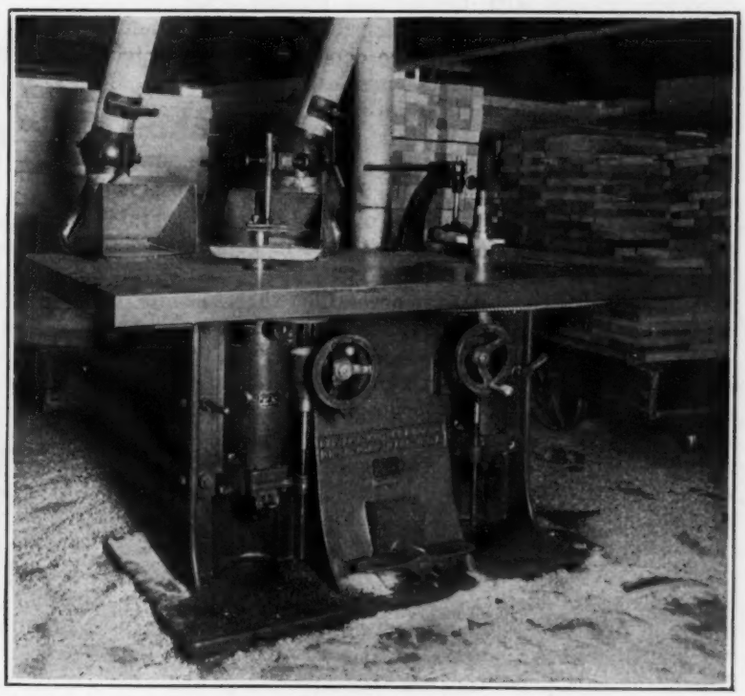
Motor Drives in a Piano Factory

Engineering Data from Representative Applications —Individual Equipment of Machines Permits Flexible Service

ONE of the most completely equipped industrial plants in Greater Boston from the standpoint of the individual motor drive is the factory of the Vose & Sons Piano Company at Watertown. Energy for lighting and power service is supplied by the Edison

*It has been ascertained that at the present time the number of Telechron secondary clocks in use in Detroit has increased to about 2,000.—EDITOR.





TYPES OF MOTOR DRIVE IN PIANO FACTORY

Diehl rip saw with 3-hp. motor at front driving feed belt and 5-hp. motor overhung at left side driving saw through shaft extension. The motors are incorporated into the machine design.

Whitney irregular molder with duplex cutters, each direct driven on vertical shaft by 5-hp. motor running 7,000 r.p.m. on 120-cycle current supplied by frequency changer in plant substation.

VARIETY OF INDIVIDUAL MOTOR DRIVES IN VOSE PIANO FACTORY

		Motor Data				Drive Data			
				Pulley			Pulley		
Machine	Make	Hp.	R.p.M.	Diam., In.	Face, In.	Belt Width, In.	Diam., In.	Face, In.	Remarks
2 Whitney No. 32 planers (each)	W	15	3,450	3	3	3	15	3	Two of these in service
1 American straight molder—planes stock up to 12x6 in. four sides at once	W	20	690	..	..	..	..	..	Shaft drive, direct
1 Diehl No. 44 rip saw	GE	3	1,800–600	..	..	..	..	..	Drives feed belt in machine
	GE	5	3,550	..	..	..	..	..	Direct shaft saw drive
1 Whitney irregular molder No. 150	W	5	7,000	..	..	..	..	..	High-frequency vertical shaft drive
	W	5	7,000	..	..	..	..	..	High-frequency vertical shaft drive
1 Moore quadruple carver	W	3	1,750	7	5	2	8	4½	Motor hung from ceiling
1 Clement buzz planer, 24 in.	W	7½	1,740	10	8	5	4	5	Motor hung from ceiling
1 Blower, 16 in. for Griff drier	W	1	.....	..	..	..	..	..	Direct connected to shaft
1 Milwaukee sander, 66 in.	W	20	690	..	..	..	..	..	Direct connected to shaft
1 Coleman band saw	W	5	490	..	..	..	..	..	Direct connected to shaft
1 Columbia No. 2 roll sander	W	20	1,140	10	6	8	22	13	Motor hung from ceiling
1 Merritt 72 in. veneer drier	W	1	1,160	4	4	4	2	4	Motor hung from ceiling
1 Dennis veneer taping machine	W	½	1,725	4½	3	2½	20	2½	Motor hung from ceiling
1 American light molder	W	7½	690	..	..	..	..	..	Direct shaft drive
1 Sheridan veneer cutter, 70½ in.	W	5	1,160	5	5	4	20	4	Motor hung from ceiling
1 Whitney planer knife grinder	W	1	1,750	..	..	..	..	..	Portable tool, shaft drive
1 Fay & Egan power feed band saw	W	10	690	..	..	..	..	..	Direct shaft drive
1 Field crosscut saw, 15 in.	W	3	1,750	..	..	4	10	5	Direct shaft drive to machine pulley
4 Field crosscut saws, 15 in. (each)	W	5	1,750	..	..	4	10	5	Direct shaft drive to machine pulley
1 Exhaust fan for sawdust removal	.....	....	.....	..	..	..	..	..	.....
1 Exhaust fan for 12 in. for sawdust removal	W	1	3,450	..	..	..	..	..	Direct shaft drive
1 Swing cut-off saw, 18 in. Rogers	W	7½	1,740	..	..	6	10	7	Shaft drive to saw pulley
2 Freight elevators, 3,000 lb. portland	W	10	720	15 teeth			40 teeth		Chain drive from sprockets
1 Motor-generator frequency set	GE	5	1,800	..	..	..	..	..	Shaft drive 120-cycle generator
1 Clement squaring-up machine	W	3	1,750	..	..	..	..	..	Motor hung from ceiling
1 Wardwell saw filer	R&M	¼	1,750	..	..	..	..	..	Worm gear drive, inclosed
1 Jennings 6 in. rotary vacuum pump	GE	3	1,800	..	..	..	..	..	Direct shaft drive
1 Goulds triplex feed pump, 3½x4 in.	GE	2	1,200	4	4½	2½	24	3	Unit in heating plant
3 48 in. Sturtevant fans (each)	S	7½	560	..	..	..	..	..	Three in dry house, direct shaft drive
1 Francis glue machine, 19 in.	GE	1	1,130	20 teeth		108 teeth			Pinion-gear drive
1 Whitney irregular molder	W	7½	1,740	6	10	4	3½	7	Double belt drive to vertical pulleys
1 Clement rip saw	W	5	1,750	8	6	4	5	5	.....
1 Maddox 6 in. belt sander	W	2	1,750	4½	4	3½	14	4½	.....
2 46-in. Sturtevant sawdust extraction fans	W	40	780	..	..	..	..	..	Direct connected
1 Mattison portable saw, 3½ in.	Motor rating unknown								Probably fractional hp.
1 Hammer boring machine, ⅛ in.	W	¼	3,450	..	..	..	..	..	Direct shaft drive
1 Rowley & Hermance wrist pin drill, 17/64 in.	W	2	1,160	5½	4	3	12	4	.....
30 Clark portable drill, ¼ in.	.....	¼	330	..	..	..	..	..	Direct shaft drive, 30 in use
30 Clark portable drill, ¼ in.	.....	¼	800	..	..	..	..	..	Direct shaft drive, 30 in use

NOTE—Two group drives are also in service: A, in wood mill a 10 hp. W. motor, 690 r.p.m., drives a main shaft from which are belted a vertical sander, grinder, two lathes, boring mill, drill, tool grinder, grindstone, horisontal borer, emery grinder, and doweling machine; B, in veneer room, a 5 hp. W. motor, 1,160 r.p.m., drives a 1x6 in. Rumsey triplex hydraulic pump and a 34 in. Bowser glue machine.

NOTE—Motor notation, W—Westinghouse; G.E.—General Electric; R&M—Robbins & Myers; S.—Sturtevant.

Electric Illuminating Company of Boston. The factory produces from 2,500 to 3,000 pianos annually with a total energy consumption of about 250,000 kw.-hr., from 80 to 100 kw.-hr. being required per piano. In this industry a large part of the processing requires highly skilled labor, and the use of electric power is concerned chiefly with the cutting up and preparation of lumber in the wood mill prior to its heat-treatment, fabrication and finishing in the departments associated with the production of these musical instruments.

The accompanying table gives the major data bearing upon the motor drives in this plant, typical close-up photographs of representative applications being shown on page 401. Power circuits are 220-volt, three-phase.

All motors driving machines of fixed location in this plant are served by rigid conduit, and in general push-button control is installed with buttons mounted on the driven machines or closely accessible thereto. As a rule starting boxes are mounted on adjacent columns. The absence of open wiring is noteworthy and with the exception of the two group drives listed at the end of the table the only belting employed is in connection with the driving of single machines by short runs from individual motors. This results in maximum freedom from obstruction and the other well-known advantages of the individual drive that contribute to operating flexibility, economy of power consumption when part of the plant is run overtime and in regular machine service on intensive production.

Group driving is advantageous for the miscellaneous machines listed in the wood mill; a 10-hp. motor is sufficient for this drive because these machines are used intermittently and rarely if ever all at once.

To furnish the high speed required by the Whitney No. 150 irregular molder a motor-generator set delivering 120-cycle current to the feeder for this machine is installed in the factory substation, in accordance with modern wood mill practice.

Electric Power Plants Consume Nearly 1½ Tons of Coal a Second

THE total annual output of electricity by public utility power plants in 1925 was 65,801,000,000 kw.-hr., an increase of 11.5 per cent over the output for 1924, according to data collected by the United States Geological Survey and just made public. These figures include energy generated by central-station companies, electric railways and certain other plants that contribute to the public supply.

The amount of coal consumed in producing electricity in 1925 was only 7 per cent greater than in 1924. The amount of oil was 38 per cent less and the amount of gas was 4 per cent less than in 1924. Although the oil consumed amounted to more than 10,000,000 bbl. and the gas to nearly 50,000,000,000 cu.ft., coal represented nearly 90 per cent of all the fuel used by electric power plants. The coal plus the coal equivalent of the oil, gas and wood used in the generation of electricity by public utility plants in 1925 amounted to about 45,000,000 tons, or an average of nearly 3,000 lb. a second, or 100 carloads an hour throughout the year.

The gain in efficiency in the use of fuel continued in 1925, as there was a decrease of about 0.1 lb. in the average consumption of coal per kilowatt-hour compared with the rate of 1924. This apparently small gain amounted to more than 2,000,000 tons of coal for the year.

Sharing Benefits of Diversity in Loads

Effect of a Changing Load Curve on Rates for Off-Peak Service and on the Theory of Cost Analysis—Equal Division of Demand Charges Among Classes of Service as a Basis for Rate Structure

By H. A. SNOW
Statistician Detroit Edison Company

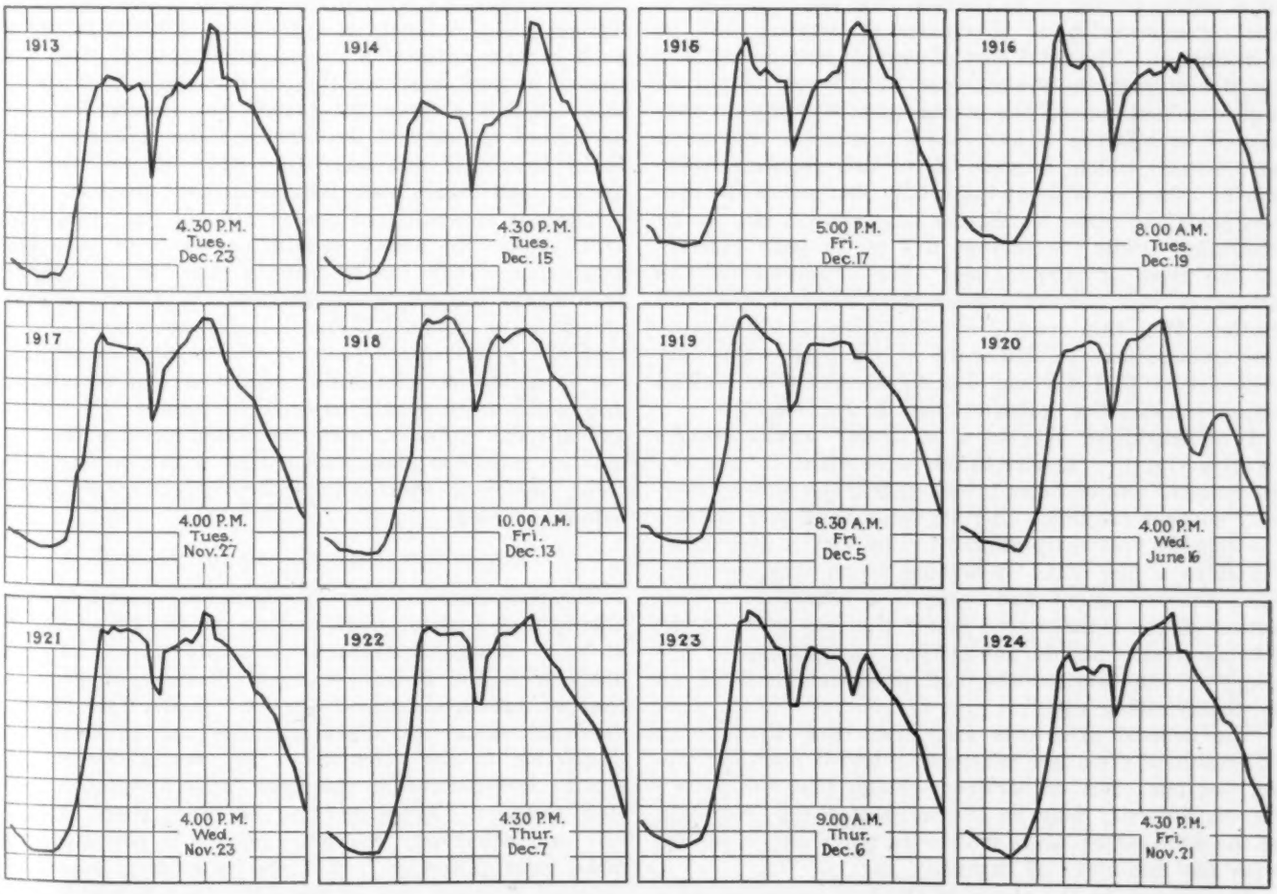
IN THE twelve-year period from 1913 to 1925 the peak day load curve of the Detroit Edison Company underwent important changes. The load curves of the peak days for each of the twelve years are plotted on the accompanying chart in percentages to show the changes in shape.

These changes were due to a variety of causes. In May of 1915 the city of Detroit adopted daylight saving time, moving its clocks ahead one hour and shifting the lighting peak one hour further to the right, thus reducing the concurrence of the power and lighting loads at 5 p.m. During this period also the factories generally adopted the eight-hour day so that their closing time at the end of the period was somewhat earlier than at the beginning. This change in closing time still further reduced the concurrence in power and lighting loads. Lastly, the growth of the power load was more rapid over the twelve years than was the growth of the lighting load, so that the power load became the predominantly outstanding feature of the load curve.

The result of these changes in the shape of the load curve was to bring about the withdrawal of a special off-peak rate for power service and to make necessary an important change in the theory of cost analysis.

Off-Peak Rate Withdrawn

At the beginning of the period the company offered a special rate with very low demand charges to power customers who would agree by contract to refrain from using service during the period of the company's peak load as specified in the contract. As the load curve changed in shape the peak became relatively smaller and smaller in comparison with the day load, and the time of its occurrence became erratic, so that it became impossible to specify in a contract the exact time at which power customers should refrain from using the service. Besides being erratic in time, the peak was



THESE LOAD CURVES ON DAY OF SYSTEM PEAK SHOW THE SHIFTING OF THE PEAK FROM ONE HOUR TO ANOTHER AND DEMONSTRATE THE DIFFICULTY OF PROPERLY APPORTIONING CHARGES ACCORDING TO PEAK RESPONSIBILITY

not large as compared with the day load, and it was therefore less necessary to build up the day load.

Under these conditions the company withdrew its special rate for off-peak service and the Utilities Commission approved the action of the company in an official order issued after an exhaustive hearing.

The withdrawal of the rate was questioned by a customer manufacturing artificial ice, who contended that his service had the merit of being an off-peak service and that by reason of this merit he was entitled to and should receive an especially low rate. Against this claim it was brought out that diversity is not and cannot be the property of one class of service, but that it is a mutual relationship existing between two or more classes. If a central-station company supplied only one class of service, there could be no diversity between classes. If a second class of service should be added to such a system, having different characteristics from the first class, there would be a saving due to the diversity between the two classes. Since this saving could not exist for either class of service alone, it must be a mutual saving and the benefits should be credited equally to the two services. Under this arrangement on-peak service would be credited with as much of the saving as would the off-peak service.

Diversity Savings and Rates

This division of the saving due to diversity is eminently fair for the purpose of cost analysis, but for rate-making purposes there is a broader general principle governing the division of savings between the two services—namely, that it is the duty of the management of a public utility so to operate that the total cost to the commonwealth of all classes of service shall be a minimum. The total cost of service may be reduced by diversifying the system load in order to obtain an improved load factor. The management is therefore warranted in offering a low rate in order to attract a new service which, because of its load characteristics, can be taken on without materially increasing the system peak. In other words, the management may in its discretion credit the savings due to diversity entirely to one class of service, and offer a special rate to attract a new service and thereby improve the load factor. It is this general consideration which permits the management to disregard at its option the suggested rule that savings due to diversity be divided equally among the several classes of service.

If a subsidized rate to a particular service results in attracting that service to the point where it ceases to be deficient and becomes predominant, the management may without prejudice alter its rates so as to withdraw the subsidy previously offered to this service and transfer it to a new class of service which may, in turn, need encouragement under the new conditions. This action of the management is for the best good of the commonwealth and is not subject to criticism by the users of the service who had previously enjoyed an especially cheap rate.

The general principles are, first, that diversity is the result of a mutual relationship and is not the property of one class of service; second, that the saving due to diversity may be so awarded at the discretion of the management as to realize the maximum of service with the minimum of expense.

The change in the shape of the load curve forced a critical study of the theory of peak responsibility as used in cost analysis and resulted in its abandonment. Overhead expense and fixed charges cannot be definitely and indisputably assigned, but must be prorated on some more or less arbitrary basis. In 1892 Dr. John Hopkinson advanced the general theory that these classes of expense should be prorated in proportion to demand. In computing the demands of the classes of service it has been customary to make allowance for the diversity among the classes because the class demands are not ordinarily coincident. The generally accepted theory is the theory of peak responsibility whereby that part of the demand of each class of service that occurs at the time of the system peak is the demand upon which costs are prorated.

Here again the progressive changes in shape of the system load curve produced complications. In 1915 the system peak occurred at 5 o'clock in the afternoon, at a time when there was a heavy lighting load on the system. Under the theory of peak responsibility a large portion of the demand costs was assigned to lighting service. The following year the system peak occurred at 8 o'clock in the morning, when the greater part of the system load was due to power service. Under the theory of peak responsibility the swing of the peak from the evening to the morning transferred a large portion of expense from lighting service to power service and produced a very severe change in the computed cost of the services—a change so sudden and so erratic as to give rise to the belief that perhaps the theory of peak responsibility might not be universally correct under all conditions of load.

The cost of service has come to be looked upon as a fixed property of the service, a property that does not change erratically with slight changes in the balance of system load. A theory of cost analysis which produces such erratic variations in computed cost as does the theory of peak responsibility, under slight changes in load conditions, does not satisfy the concept of cost as a fixed property of the service. The peak responsibility theory is not acceptable when the balance of system load varies materially from time to time.

There is an additional reason why the peak responsibility theory is not a satisfactory one, in that the acceptance of this theory assumes that the saving due to diversity should be assigned to the several classes of service in unequal degree. It has been pointed out that diversity is not a property of one class of service, but is a mutual relationship, and that the economies due to diversity should be credited equally to on-peak and off-peak services, with the added proviso that in making rates the management may subsidize the deficient classes of service in order to produce a better balance of load.

Equal Division of Demand Charges

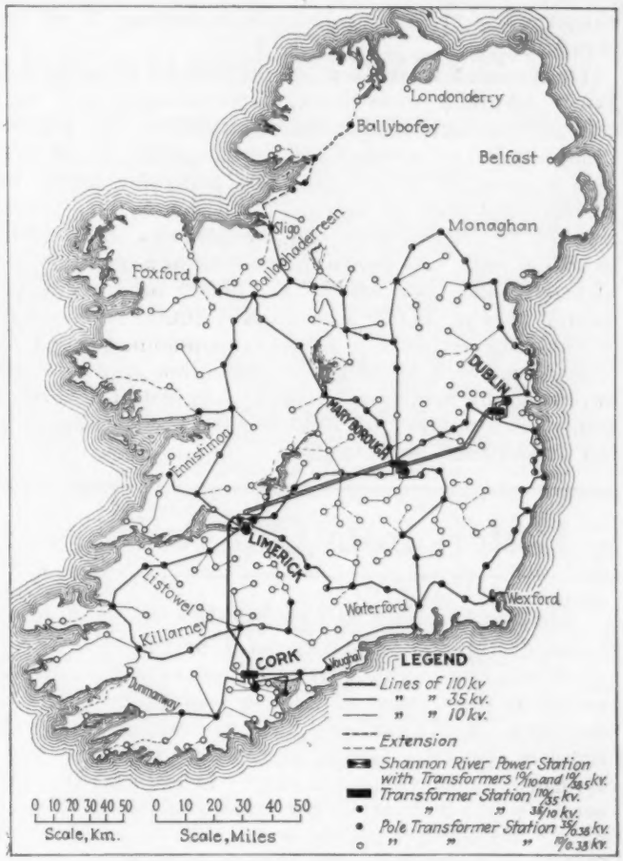
The peak responsibility theory is only partly acceptable in cost analysis work under a particular condition of load. A more universally acceptable theory of cost analysis is the theory of equal division of demand charges among classes of service. Under this theory overhead costs and fixed charges are prorated in proportion to the demands of the several classes of service irrespective of the time of occurrence of the class demand. After dividing overhead costs in this fair and equal way the management is permitted to make rates differing from costs in order to subsidize deficient services and improve the load factor to the benefit of all services.

Proposed Shannon River Development

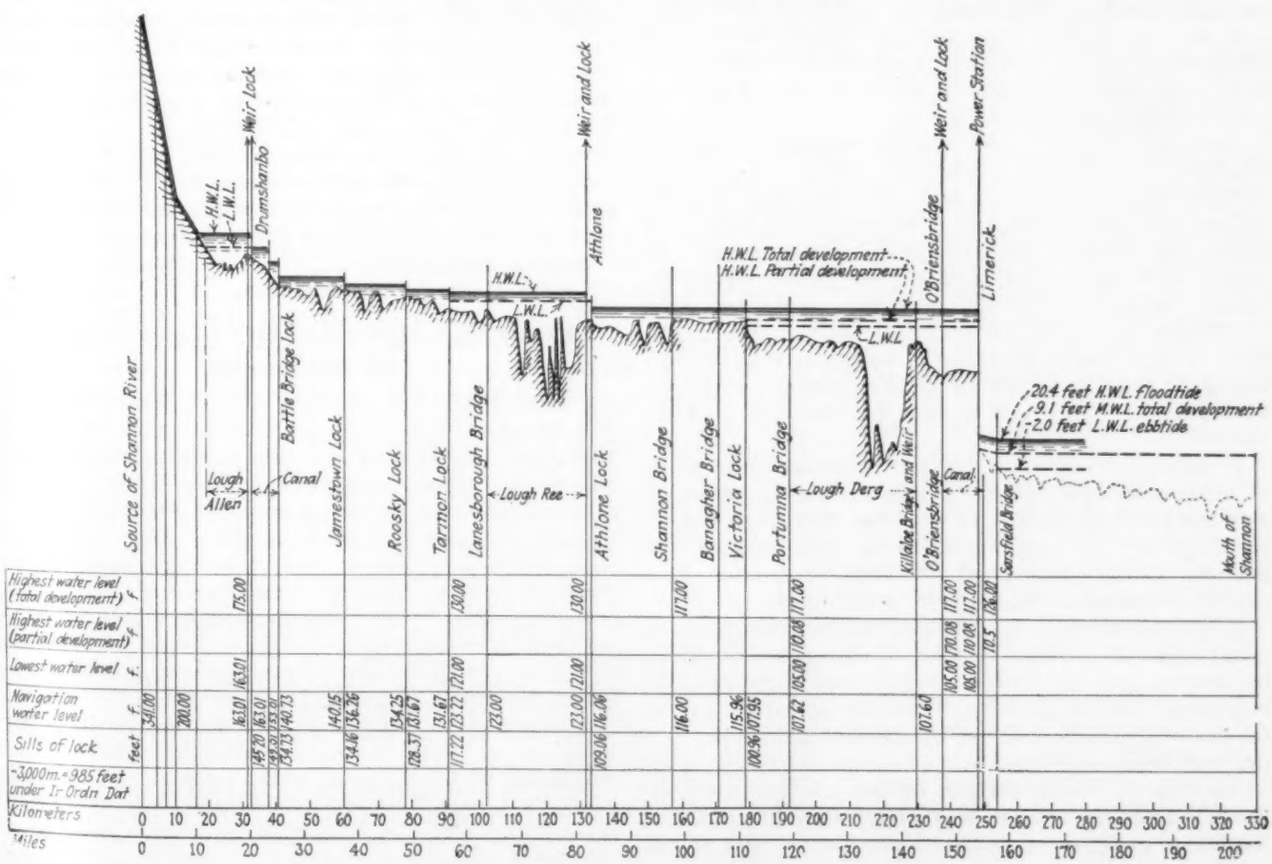
Initial Installation of 75,000 Hp. with 100-Ft. Head—Transmission Potential to Be 110,000 Volts

SEVERAL plans have been proposed in recent years for developing water power to be used for the electrification of Ireland. The Shannon River is the largest in the country and has been the subject of most projects. Some of the plans contemplated developing power at several different sites in successive steps, but the one favored by the Irish Free State Government was submitted by the Siemens-Schuckert Company of Germany and provides for development of all the power at one site about three miles north of Limerick. Three lakes, Lough Allen, Lough Ree and Lough Derg, will form the storage and regulating reservoirs. Embankments will be necessary to prevent overflowing the lower surrounding country and by raising the embankments and increasing the storage the initial installation of 75,000 hp. can later be raised to 165,000 and even to 195,000 hp.

The power house will operate with a head of about 100 ft., which will be obtained by building an inlet canal from Lough Derg to the power house. The initial installation consists of two 30,000-hp. and one 15,000-hp. units. It will be possible to take full advantage of the original storage capacity of 324,000,000 cu.m. of water and will average an output of 53,000 hp. through the year. By adding four more 30,000-hp. units and increasing the storage capacity to 827,000,000 cu.m. the



HIGH-TENSION DISTRIBUTION NETWORK



LONGITUDINAL PROFILE OF RIVER SHANNON

output of the project can be made to average 75,000 hp. through the year.

The generators are vertical 30,000-kva. (one 15,000-kva.), 50-cycle, three-phase, alternating-current machines direct-connected to the waterwheels. The 30,000-kva. units have a speed of 150 r.p.m. and the 15,000-kva. unit a speed of 188 r.p.m. The generator rating of 10,500 volts will be stepped up through two transformers to 110,000 volts and through one transformer to 38,500 volts. As shown in the diagram, transmission to Dublin and Cork will be at 110,000 volts, with secondary lines of 35,000 and 10,000 volts. The sponsors of the plan estimate a present maximum demand of 51,900 kw., with an annual consumption of 97,500,000 kw.-hr., and a maximum demand of 81,000 kw., with an annual consumption of 152,100,000 kw.-hr., when the full development is completed.

Letters from Our Readers

Electric Washers in Use Number 4,335,000

To the Editor of the ELECTRICAL WORLD:

I should like to call your attention to a discrepancy as regards the number of electric washing machines in use given in the article "Central-Station Appliance Sales" in the Jan. 2 issue of the ELECTRICAL WORLD. Evidently the percentages in regard to washing-machine saturation are built up on the table on page 62, "Number of Electrical Appliances in Use in the United States," in which you give clothes washers in use as 2,642,000. We have sold in the washing-machine industry from 1920 to 1925, inclusive, 3,154,230 "electrics," and we had at least four very substantial years preceding that period. With this total number of machines sold since 1916, there should be in use not less than 4,335,000 electric washers.

There were sold by the washing-machine industries in 1925 726,222 electric washers. This is a gain of 114,159 units, or 18.6 per cent over the sales of 1924. In addition to the electric washers, there were sold 92,758 hand-power washers, 20,773 water-power machines and 35,745 gas and engine power machines, which, with the 726,222 electrics, make a total of 875,498 washers of all kinds for the year 1925. The total retail value of all types of machines sold in 1925 was $111,270,000, of which amount electrics made up $103,500,000. This was a gain for electrics of $16,180,000.

It might be interesting to note, further, that there is no seasonal period in the sale of electric washers. For the last ten months in the year there was only a variation in the number of units sold between the poorest month—December (59,894)—and the best month—September (66,601)—of 6,707 units.

The distribution of all types of washers measures in retail value 28 per cent to jobbers, 71.5 per cent direct to dealers and one-half of 1 per cent direct to the consumer. Of the jobber distribution 70 per cent went to electric jobbers, and of the dealer distribution 19 per cent went to central-station companies, 5 per cent to electric wholesale dealers, 38 per cent to specialty dealers, and the balance was distributed through the hardware trade, the furniture trade, department stores and miscellaneous.

ENOCH B. SEITZ,
Executive Secretary.

American Washing Machine Manufacturers' Association,
Chicago.

Suggests an International Competition for Motor Designers

To the Editor of the ELECTRICAL WORLD:

With reference to the letter by F. I. Hiss in your issue of Nov. 21, 1925, and to the article of J. C. Hobart, printed March 14 of that year, which, while pointing out "the enormous waste which is going on all over the country due to the indiscriminate use of low-resistance squirrel-cage motors on polyphase circuits," at the same time recommend the use of self-starting, high-power-factor, high-efficiency motors, it occurs to me that this question deserves to be treated with great consideration and that electrical engineers should be encouraged—as, for instance, by a substantial reward in an international competition—to bring out a short-circuited three-phase motor. Such a motor ought to meet the following requirements:

1. The rotor winding should be of the squirrel-cage type or any other short-circuited winding without insulation, thus offering the best solution of a fireproof and foolproof rotor.

2. In starting, the motor should comply with the same conditions as the slip-ring motor with regard to the torque and the current rush, and during the starting no speed drop should occur.

3. It should not require a starter or a compensator or a centrifugal device, but only a switching apparatus in the stator circuit.

4. It should be applicable for any number of poles.

5. Its efficiency and power factor should be as high as for the slip-ring motors, but with 2 per cent tolerance.

A short-circuited motor with the above properties would offer such enormous advantages that all factors in the electrical line, as well as all users whose motors are exposed to dangers from fire and explosion, would have the greatest interest in encouraging the inventors to search for a perfect solution of this problem. The international competition possibly should include reservations whereby the patent rights would be kept intact; the terms also might require the submission of a model of the motor and might permit about a half a year for the competitors to finish their work.

Budapest, Hungary. THEODORE TORDA.

American Capital for the Electrification of Budapest

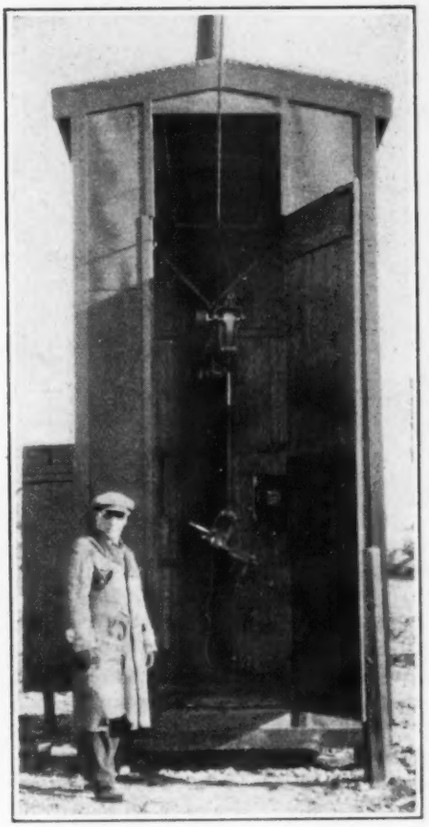
ACCORDING to an official report from Budapest, the American-European Utilities Corporation of New York has submitted to the municipal administration of the Hungarian capital an offer for the erection of an electric central station powerful enough to supply the entire electricity for the capital. The corporation engages itself to pay an annual rent corresponding to the amount which the city of Budapest has to pay to its foreign creditors. This amount varies between 7,200,000 and 11,800,000 gold crowns. At an expenditure of $11,000,000 a powerful electrical central power station is to be built at Budapest, $7,000,000 to be invested in the first three years and $4,000,000 in the following three years. Of the gross earnings the city of Budapest will receive from 2.5 to 3.5 per cent, the total not to fall below 700,000 gold crowns per year. All the various plants and installations of the city will be electrified, and during the time of the contract the city will not be allowed to grant concessions for supplying electricity to any other company or individuals.

Central Station and Industrial Practice

Motor-Driven Pole Shaver Saves $2,800 per Year

BY H. K. BROWN
General Superintendent, Malden Electric Company

SLIGHTLY more than a year ago the Malden (Mass.) Electric Company installed a motor-driven pole shaver at its Bell Rock yard at an investment cost of about $1,000, and during 1925 it is estimated that this equipment saved the company about $2,800 through reduced labor requirements and increased speed of shaving. The shaver was built by the P. L. Billingsley Company, Cincinnati, Ohio, and consists of a trolley carriage from which is suspended a 2-hp., 220-volt, three-phase motor belted to a set of revolving knives by which the shaving is done. The carriage runs on a ⅝-in. stranded steel cable, and this cable, with two hard-drawn copper wires suspended above it, supplies energy to the motor. The cutter and motor are arranged to counterbalance each other at the end of a pivoted arm acting as a frame for the device. The cable at Malden has a span of 175 ft., and it terminates on a pole behind a 6x10x12-ft. weatherproof house containing a service pipe, meter and main switch and affording coverage when the shaver is not in use. Provision is made in this house for sharpening the knives under their own power. The motor and shaver cost about $490, the erection of the house and wiring about $300, and the erection of the poles and cableway about $125. Two poles were required, set in cement and backguyed, and the supporting cable is from 12 to 13 ft. above the ground.



HOUSING FOR POLE SHAVER WHEN NOT IN USE

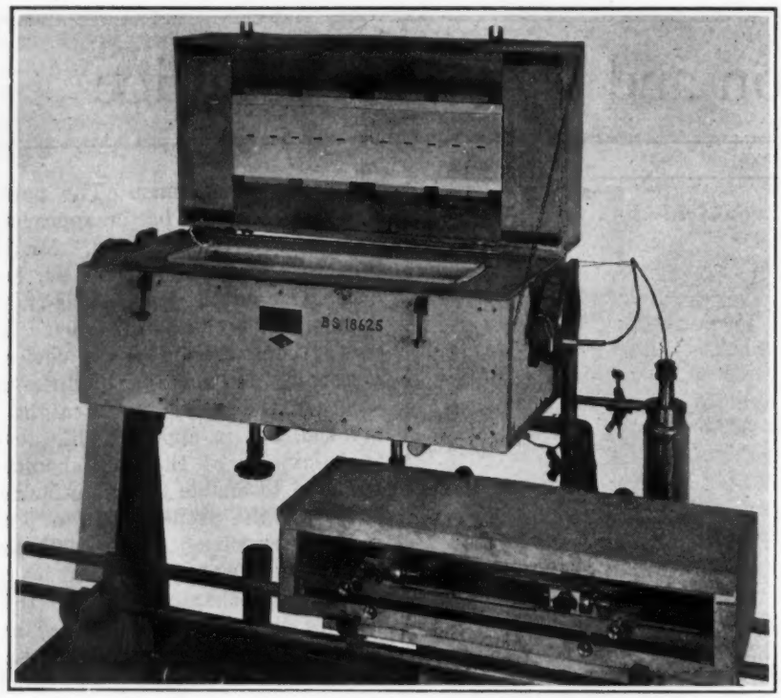
In eight hours one man can shave from eight to eleven chestnut poles 35 ft. long, whereas four additional men were formerly required when these poles were shaved by hand. Very little vibration occurs and the work can be carried on as well in winter as in summer. The power-shaved pole has a better appearance than one shaved by hand. Men on this work are paid 53 cents per hour and a fair output is 350 pole-ft. per man per day (wage $4.50). The energy consumption of the device is nominal. It makes no difference whether the poles are straight or crooked, but in applying this device the diameter of the pole should be specified to enable the manufacturer to supply the proper shape of knife to the curvature. About 1,500 poles a year are now being shaved by this company mechanically. The thickness of the shave is regulated by a shoe at the bottom of the knife blade. The only maintenance trouble experienced was through the effect of dampness on the belt, and this has been cared for by substituting a waterproof belt. From four to twelve poles can be shaved per knife.

POLE SHAVING BY ELECTRICITY

Thermal Expansivity of Insulating Materials

IN THE government testing laboratories at Washington interesting experiments are being carried on to determine facts regarding the expansion of various insulating materials. Specimens of the material under test are cut from larger sheets and placed in an air furnace. In the furnace the specimens are supported horizontally with a platinum wire hanging over each end. Each one of these wires hangs through a hollow tube below the end of the specimen and extends downward through and below the furnace. At its lower end is a weight immersed in oil to damp vibrations. Heating is effected by electric resistance coils. With careful manipulation it is possible to adjust the circuits so that during an observation the specimen is at a uniform temperature within 0.1 deg. C. from end to end.

The changes in the lengths of the samples were determined with a comparator, which consists of two microscopes clamped rigidly to an invar bar at a distance from each other equal to the length of the specimen. The microscopes were arranged so that they will sight first



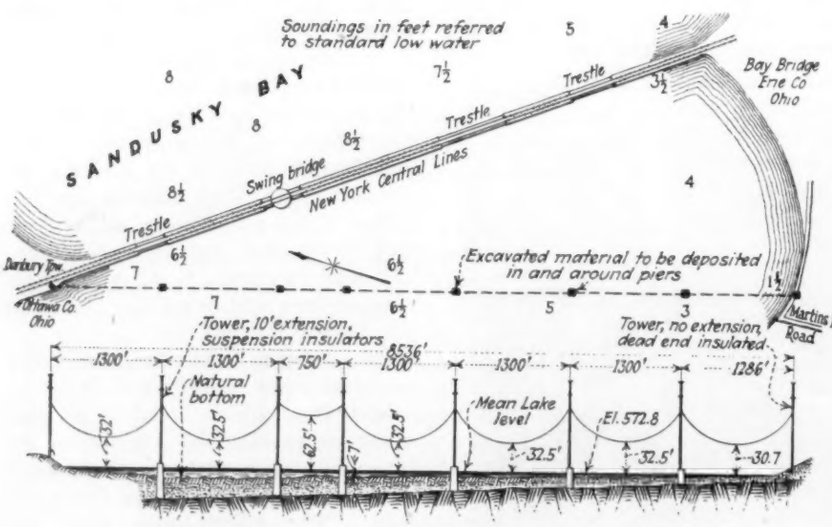
FURNACE AND TRAVELING MICROSCOPES USED IN MEASURING THE EXPANSIVITY OF INSULATING MATERIALS WHEN HEATED

on a standard-length bar kept at a constant temperature and then on vertically suspended wires which are in contact with the ends of the specimens.

132-Kv. Transmission Line Across Sandusky Bay

BY H. A. PEARCE
Engineer Ohio Public Service Company, Sandusky, Ohio

A DESCRIPTION of the method of building tower footings for the Ohio Public Service Company's 132,000-volt transmission line crossing Sandusky Bay was given in the ELECTRICAL WORLD of Feb. 6, page 304. Each of these foundations supports a double-circuit suspension tower weighing about seven tons and carrying six 336,400-circ.mil steel-core aluminum cables suspended by twelve-unit insulator strings. The towers are fastened to the foundations by two 1¾-in. round anchor bolts per leg. The over-all height of the towers is 108 ft. above the foundation. Six spans of 1,300 ft. have a clearance of 32 ft. 6 in. A channel span was required by the government and the clearance was specified as 62 ft. 6 in. To give this clearance with the same tension (8,000 lb.) in the conductors on this span as on other spans, a span length of 750 ft. was used.

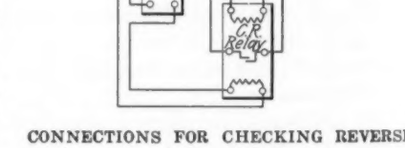


LOCATION MAP OF 132,000-VOLT SANDUSKY BAY CROSSING

Checking Reverse Power Relays

BY J. R. HALLADAY
Meter Department, Ohio Public Service Company, Cleveland, Ohio

CHECKING reverse power relays under conditions as near actual operation as possible is obtained in a new test set of the Ohio Public Service Company by making the connections shown in the accompanying diagram. A potential is supplied to the watt element at about 1 per cent of normal and test currents are supplied equal to short-circuit values. The potential is obtained by a potentiometer connection of two resistors, one approximately 400 ohms and the other 40 ohms tapped at intervals to give different values of voltage up to about eight volts. Tests are made at one volt and if the relay does not function, the voltage is increased and the minimum voltage at which the relay operates is recorded. Usually, by readjustment and cleaning, operation is obtained at one or two volts. The



CONNECTIONS FOR CHECKING REVERSE POWER RELAYS

use of this set has proved very satisfactory in the maintenance of relays on the Ohio Public Service system and records have shown almost perfect relay performance as the result.

Surface Air Coolers with Hydro-Electric Generators

THE first use of fin type surface air coolers with hydro-electric generators will be made in connection with the new station being built by the Louisville Hydro-Electric Company just above Louisville, Ky., on the Ohio River. Because of the use of soft coal in the city and the consequent trouble that would be caused if open ventilation of equipment were used, it has been decided that the closed system of ventilation

would be preferable. The major use of surface air coolers has been with turbine-generator equipments.

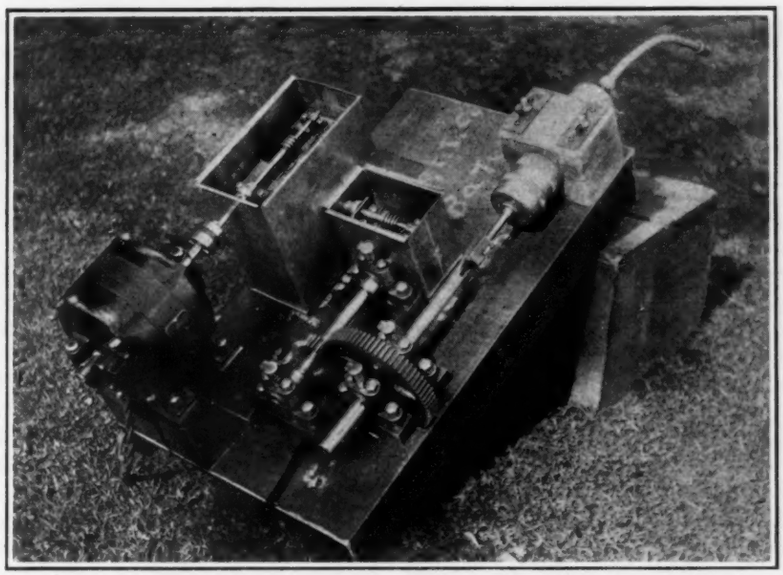
The generating equipment of the new station will include eight General Electric 10,000-kva., 14,000-volt, 100-r.p.m. hydro-electric generators, each equipped with fin type surface air coolers. The development is being made at the site of one of the state-built navigation dams. According to the season, the head varies to a maximum of 40 ft. The power developed there will be used in and around Louisville.

Grease Gun Saves Stuffing Box Bearings

BY J. H. SIEGFRIED
Superintendent of Power Pacific Power & Light Company, Kennewick, Wash.

MODERN vertical hydraulic units are designed with a stuffing box, usually of babbitt, between the runner and the steady bearing to prevent leakage of water after the runner clearances increase from wear. Leakage is greatest during high water periods when the water contains more or less sediment, with the result that the babbitt is badly cut and the stuffing box cannot properly perform its function. Lubricating oil is ineffective, and in order to overcome this cutting out of the stuffing box and the resultant leakage the Pacific Power & Light Company uses an ordinary Alemite grease gun driven by a small electric motor through a reduction gear and permanently mounted on the hydraulic unit. The lightest type of cup grease is used, and this lubrication has been found very effective in prolonging the life of the stuffing box. In one installation where the stuffing box would cut out and cause bad leakage in six months it has been operated almost perfectly for two years after the installation of one of these grease guns.

The accompanying illustration shows the complete motor and gearing as arranged for the Naches plant. The first and second speed reductions are made by means of worm gears. The first reduction is 100 to 1, the second 50 to 1, and the third 4 to 1. The worm gears are inclosed in tin boxes partly filled with oil to insure lubrication. The grease gun is clamped between two wooden blocks so that it can be disconnected from the driving mechanism and opened for filling. A keyway is cut in the shaft driving the grease gun, and the key in the large spur gear slides through this keyway as it revolves.



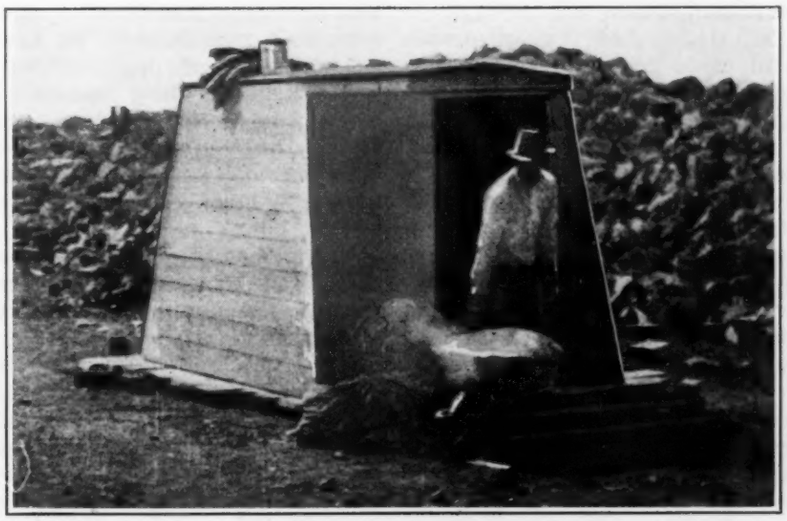
MOTOR-OPERATED GREASE GUN PREVENTS LEAKAGE AROUND STUFFING BOXES ON WATERWHEEL BEARINGS

These grease guns are filled once in 24 hours and are geared to run for 30 hours. Installations have been made at the Naches Drop plant, the Naches plant and on the unit at the Powerdale plant at Hood River.

Protecting Cement on Construction Work

BY T. C. RUHLING
Superintendent Underground Construction Kansas City Power & Light Company, Kansas City, Mo.

THE usual method of storing concrete along the conduit construction trench is to cover 100 to 200 sacks of cement with canvas or tarpaulin. This cement is usually placed at 100 ft. or 200 ft. intervals on the work, and experience has shown that a great many sacks of cement are destroyed because either the men are careless in covering the sacks with the canvas or during the night a heavy storm beats the water through the canvas or a heavy wind lifts the canvas. This waste can be avoided by the use of a small cement shed. The illustration shows a shed designed by the writer for this purpose which will hold 100 sacks of cement. The cement is always kept dry and off the ground. The shed is portable and is put up in 30 minutes. It is made in six parts, two long sides, two ends, the floor and the roof, which are all hooked or bolted together. As the work progresses, the shed can be either moved as a unit or taken apart and moved in sections. This cement shed has had considerable use and has proved to be very satisfactory.



PORTABLE CEMENT SHED SAVES CEMENT ON UNDERGROUND CONSTRUCTION

Statistical Data on Power Houses and Substations

BY ROBERT M. GROMBLING
Statistician Operating Department,
Southern California Edison Company,
Los Angeles, Cal.

THE statistical division of the operating department of the Southern California Edison Company keeps property and operation records on the following subjects and finds them of great value because of the time and energy saved by having all these data concentrated in one central file:

1. Single-line, three-line and plot plan diagrams.
2. Transformer record sheets.
3. Load curves on substation transformer banks.
4. Inventory of major equipment in all stations.
5. Photographs of all stations, both inside and outside equipment.
6. Building and property data.

Single-line wiring diagrams of all stations are supplied to the following department heads, who keep them on file for reference: Chief electrical designing engineer, dispatching superintendent, superintendent and assistant of substations and station chiefs.

Each station chief is supplied with postal cards addressed to the statistician of the operating department. He is required to mail one of these each month, reporting whether or not any changes have been made in his station during the month. When these cards are received, those reporting changes are kept in an open file until a full report has been received covering the changes made. As a check, any department making changes is required to send in sketches and reports. The single-line drawings include all major apparatus, with the size, voltage and make of transformers, generators and condensers. Relay protections of all equipment are shown. The three-line diagrams show all wiring, and the plot plan shows the location of all buildings, racks and outdoor equipment and transformer and distribution line get-away.

Five copies of the transformer record sheet are filled out for every transformer on the system of 250 kva. or larger, regardless of whether the transformer is in service or in the shop or storeroom. Two copies of the record are filed in the statistician's office, one according to serial number and make of the transformer and one according to location. The others are filed in the office of the dispatching superintendent, testing superintendent and in a tube fastened to the transformer.

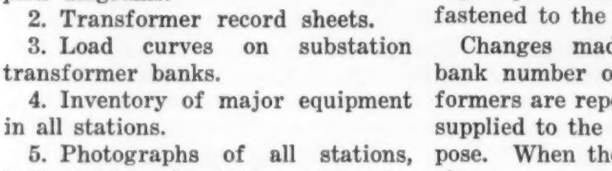
Changes made in voltage taps, bank number or location of transformers are reported by postal cards supplied to the station for this purpose. When these are received, notices are immediately sent out to the departments, which have record sheets on file and the necessary changes are made. In case a transformer goes to the shop for repairs, a record is made on the sheet as usual and a note on the back indicates the work that has been done.

As there are more than 1,200 250-kva. or larger transformers on the company's records, with an aggregate capacity of nearly 3,000,000 kva., and as these sheets are referred to continually by the engineering, protection, operating, construction and maintenance departments, a system of this kind is very worth while.

The method of plotting peak load curves on substation transformer banks is indicated by Fig. 1. Each station chief sends in this curve every month and on it is plotted daily peak ampere readings, daily peak temperature readings and also a curve showing load for the peak day of the month. The peak reading is then taken from this curve sheet, and a curve is plotted that takes in several years. Such a curve is shown in Fig. 2. In case several transformer banks are in parallel, the curve shows the total peak load. A dotted line on the sheet shows the ampere capacity of transformer banks, and when transformer capacity is increased, the change in the dotted capacity line shows the date changes are made. It is not hard to estimate from this curve the approximate time at which the transformers will be loaded, and plans can be made months ahead of time to avoid overloading apparatus.

Inventories of all stations are kept in the operating department file. Copies are sent to the following departments, where they are kept on file: Accounting, valuation, insurance, dispatching superintendent, assistant superintendent of substations and to the particular station.

Pictures of stations are taken periodically. If changes are made at stations, these pictures include a number of outside views as well as some of the inside equipment. They are for reference and the use of all departments. Property land books are kept on file, which show a plot plan of the portion of the city around each station site, giving the number of all lots and other description, as well as a history of the property, with past and present owner and other information. Sheets are kept on file describing all buildings, giving all dimensions, description of building, by whom built, date and cost. All of this information being concentrated into one central file has proved very beneficial, as it has saved many trips to the field, which means a great saving in time and expense for all departments and gives all departments a basis on which to work when planning for future stations, equipment, lines, etc. Another point worthy of note is the fact that the company has had no transformers burn out due to overload since 1923, when this system was started.



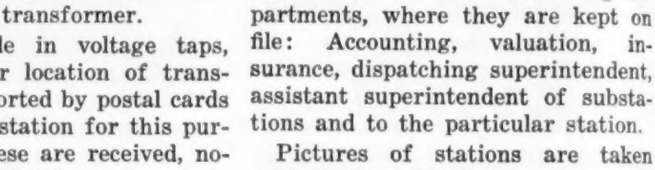


FIG. 1 (LEFT)—CONTINUOUS LOAD RECORD FOR STATION TRANSFORMERS. FIG. 2 (RIGHT)—YEARLY TRANSFORMER LOAD RECORD

Commercial Activities and Public Relations

Employers Spread Stock Among Customers

Sell $5,000,000 Worth of Cities Service Company Securities in Ten Days' Campaign

CITIES SERVICE COMPANY is one of the utility organizations that maintain a customer-ownership department for the purpose of periodically organizing employees of subsidiary companies to sell the company's securities. This department uses a carefully worked out plan which officials claim is so effective as to make salesmen out of even employees of very limited education. Under this plan employees in 1925 sold in the neighborhood of $18,000,000 par value securities. This figure does not include any sales made by the regular force of security salesmen.

One noteworthy example of how successfully the plan operates is the "Midwest campaign" held in a group of Cities Service subsidiaries in the central part of the country. The campaign began on Nov. 19, 1925, and lasted just ten days. In that short period of time employees sold more than $5,000,000 par value of Cities Service preferred stock to 13,560 purchasers.

About 6,000 employees participated in the big sale—employees scattered from Canada to lower Texas. Among the Cities Service subsidiary companies in the drive were such companies as the Empire Gas & Fuel, with headquarters at Bartlesville, Okla.; Kansas City Gas Company; Wyandotte County Gas Company; St. Joseph Railway, Light, Heat & Power Company; Empire Refineries, Inc., with headquarters at Tulsa, Okla.; and Cities Service Oil Company. The latter organization, which markets oil, has branches in Toronto, Canada; St. Paul, Chicago, Tulsa, Fort Worth and numerous intermediate points.

Several months before the campaign started all of these various units were organized by mail instructions to executives and by traveling representatives of Cities Service Company. Enthusiasm and competitive effort were stirred to the boiling point, so that the sale started off with great momentum.

Back of the employees' efforts was an effective advertising campaign. Mediums used were newspapers and direct mail. It is claimed that the advertising did a great part of the job. It helped to build public confidence, opened the gates and got employees past the thresholds.

The main feature of the general plan was the compilation of a prospect list by employees. Each employee of the organization was requested to turn in the names of twenty persons he considered good prospects. Approximately 100,000 names were secured. Direct-mail advertising was sent to these people. After the direct-mail advertising had been received, and while the newspapers were carrying full-page and smaller advertisements, each employee called on his twenty people.

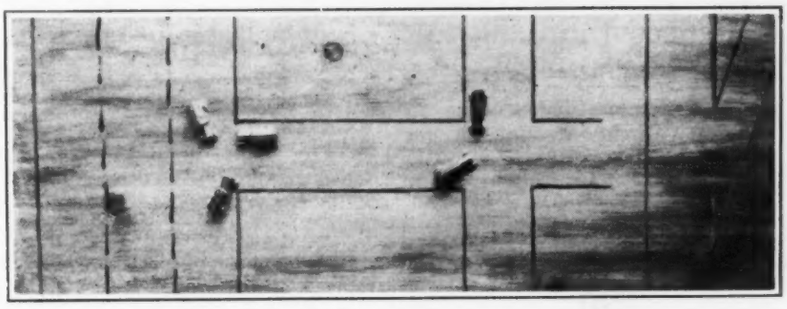
It is interesting to note that the average number of shares bought per purchaser was 3.7. The greater number of buyers gave small orders —for one share, two, three, five or ten shares. Of course, quite a few orders for 50, 100 or more shares were taken; but the average of 3.7 shares shows what a wide distribution for its stock the company obtains.

Of course, this wide distribution is exactly what the company wants. As a matter of fact, the purpose of this campaign was a redistribution of stock bought up from large holders. No new stock was sold and no new capital was raised. This fact is rather striking evidence of how important Cities Service organizations consider the customer-ownership movement, which scatters its securities throughout the country, develops friendship, good will and co-operation over a wide area and creates thousands on thousands of boosters for the organization.

With the new year, officials of Henry L. Doherty & Company are planning to extend their customer-ownership activities on even a greater scale. They have found that it pays.

"Spotting" Automobile Accidents

THE better to visualize conditions prevailing on the streets at the time of automobile or truck accidents involving the staff of the Malden (Mass.) Electric Company, the map illustrated is used by the company's investigating board. On a wooden background 2 ft. wide by 3 ft. long street lines and intersections are drawn, with center lines of electric railway tracks, and each accident reported is "set up" on this map with the aid of miniature automobiles. In this way conditions are studied to advantage and steps taken to improve the methods of motor car operation.



TOY MOTOR CARS FACILITATE ACCIDENT STUDIES

Red Cross First-Aid Class Formed in Georgia

AS A further step in safeguarding the lives and health of the public as well as company employees, the Georgia Railway & Power Company has formed a Red Cross first-aid class consisting at present of 30 employees. It is expected that within a short time every employee of the company will have been trained to render first-aid treatment for emergencies of any kind. Completion of the course now being taught will equip the 30 members of the present class to serve as lay instructors and,

according to plans, these men will act as instructors for others in their respective departments. As the class has been organized, every department of the company is represented.

Lieutenant-Colonel M. J. Shields, of the medical reserve corps of the United States Army, has been brought to Atlanta to take charge of the first-aid class. The instructions cover treatments for all kinds of accidental injury, how to carry injured, common emergencies in the home and in sports and organization of first-aid instruction classes. The treatments prescribed will, of course, be given only while awaiting arrival of a physician.

This class is only one of the many safety activities of the Georgia Railway & Power Company, and during 1925 this work proved so effective that the monthly average of accidents to employees of a nature sufficiently serious to cause loss of time from work fell to 21, as compared with 35 in 1924.

Intimate Relations of Utility Reflected in Bank Advertising

WHEN a bank features in its publicity the strong position of the local utility, two conditions are almost certain to exist: the bank recognizes a good thing when it sees it; the utility through its management has established the most intimate contact with its local commercial institutions and the press. A few days prior to the appearance of the advertisement shown in the illustration one of the local newspapers of Piqua, Ohio, carried a rather comprehensive story on the service rendered by the Dayton Power & Light Company to the city of Piqua, emphasizing strongly that adequate facilities were always established well in advance of their needs, which assured an adequate power supply for the city in its future growth. The theme was picked up by the bank and carried into its publicity as disclosed by the advertisement.

Save and THRIVE in '25
Providing Reserve Power
Piqua, we are told, has surplus electric power sufficient to serve a city of 50,000 people. Thus, future growth for many years is amply cared for.
The growing practice of paying all bills by check creates surplus financial power that benefits not only the community but the individual.
More business can be transacted, and transacted more easily and without chance of error when the available currency is supplemented by checks.
Thus, when you have a Checking Account at the Citizens National Bank & Trust Company, you contribute to your own convenience and to the prosperity of our city. We invite your account.
CITIZENS
National Bank & Trust Co.
The Home of the Christmas Club
Open Saturday Evenings, 6:30 to 8:30

INTIMATE RELATIONS WITH BANKS AND PRESS DEVELOP UNEXPECTED UTILITY SUPPORT
Advertisement in Piqua (Ohio) *Daily Call.*

Shall Commercial Executives Come from Outside?

Some Specific Viewpoints as Well as Some Direct and Indirect Influences that Might Follow the Adoption of Such a Procedure

An Interview with
B. J. DENMAN
Vice-President and General Manager United Light & Power Company, Davenport, Iowa

"WHAT do you think of the suggestion made in the Sept. 19 issue of ELECTRICAL WORLD under the title, 'An Experiment with the Great American Market'?" B. J. Denman, vice-president and general manager of the United Light & Power Company, Davenport, Iowa, was asked recently. The editorial questioned what might happen if all electric light and power companies recruited their commercial executives from the men who have made the greatest national successes in selling articles for household use.

"If the editorial is an implication of failure of the industry to merchandise successfully, it is not true," replied Mr. Denman. The electrical industry has been alive to modern selling methods and the co-operation throughout the industry has been splendid. Of course there are spotted exceptions of lack of co-operation by contractor-dealers, but I believe even this co-operation can be secured if central stations will not act alone but will participate in local electrical co-operative leagues.

"On the other hand, if the editorial is an implication that selling is one of the greatest problems, if not the greatest one, and that the industry has not measured up to its possibilities, it is true," continued Mr. Denman. "I believe that many of our present sales managers are unduly restricted in their activities and are not given the positions they should have. If we give them sufficient leeway, I think many of the sales managers would surprise us.

"Regarding merchandise sales, the utilities must consider whether they desire merchandising profits or increased revenue per meter. If only the latter is desired, should the utility cut all merchandising profits and thereby weaken the contractor-dealer and jobber? The editorial intimates and present practice points to the desirability of maintaining prices that will give a fair profit, thus enlisting co-operation of all electrical interests. With this I agree.

"However, I do believe that the sales problem of utilities is considerably different from that of non-electrical industries. Utilities must consider broad policy matters that include political considerations, public relations and co-operation with dealers. If commercial executives were brought from outside the industry, they would know nothing of the traditions of central-station relations and could hardly be expected to administer its policies safely. As to giving such a man the background of the industry in a short course of schooling, it just can't be done. Rate problems are involved regarding which they would know nothing.

"The utility field is local, not national, in scope. The local field must consider public policies which the national selling does not have to take into account. Furthermore, the administrator of national selling can command a higher salary than that which local selling can support. It is also a question of whether high-pressure sales methods are desirable in utility selling. Great care has to be exercised by utilities to avoid creating dissatisfied customers, as might result from high-pressure methods.

"Finally, it would be unfair to present utility executives to bring in outside men at the higher salaries

that would be demanded by men who have achieved national success in administering national selling for non-technical industries. Utilities cannot afford to overlook the fact that good service comes first, and that requires good engineering and good operation. No amount of high-pressure selling would offset poor service. If the operating and engineering executives are receiving salaries commensurate with the importance of their positions, their salaries will not be exceeded by those necessary to attract the highest type of sales executive.

"I cannot help but repeat that if we give our present sales managers sufficient leeway I think many of them will surprise us."

Electric Truck with Four-Wheel Drive

THE Cleansing Department of Birmingham, England, recently put into operation a new type of electric tipping refuse cart manufactured by Electromobile, Ltd., Otley, York, specially designed to possess a high tractive effort and capable of being used on very bad road surfaces. There are many points of interest in the design of this particular vehicle. One outstanding feature is that the machine is provided with four-wheel drive, each wheel being driven by a 2¾-hp. motor. This arrangement insures a much greater tractive effort than is obtained with the drive operated on the back axle through chains, gearing or differentials. Further, if one wheel slips, it does not affect the driving power on the others. The drive is taken from each motor to its wheel by means of high-ratio compound gearing, the final drive being made through teeth on a brake drum which forms part of each wheel. This provides braking on each of the four wheels, and in addition there is the usual form of electric braking through the controller. The battery, an Exide-Ironclad, is slung beneath the chassis frame.

The controller handle, mounted beneath the steering wheel, provides for four forward and three reverse speeds. Each motor is worked independently and is wired separately to the controller.

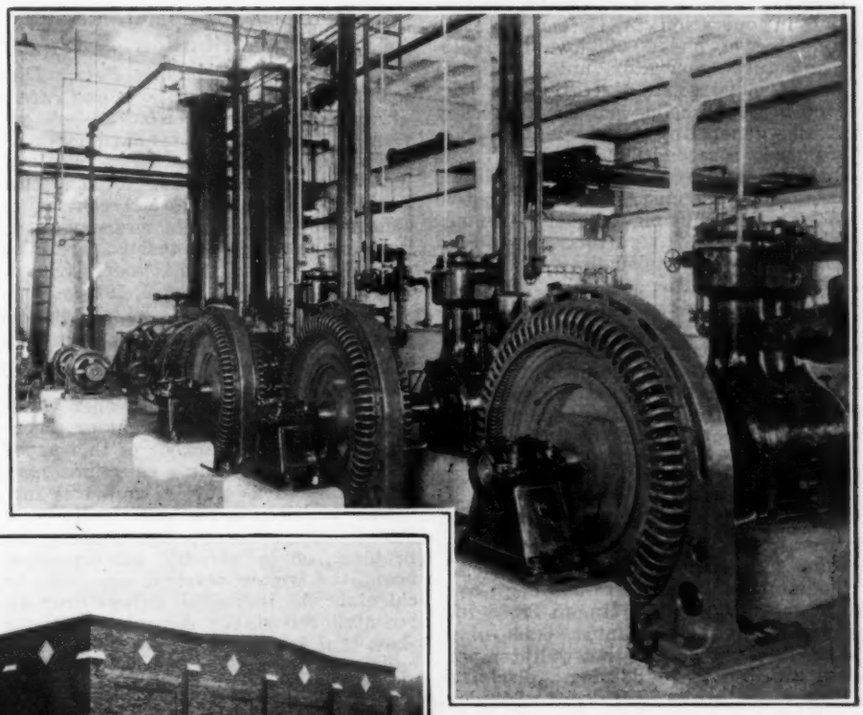
The body has a rated capacity of five tons, but it has been found that a 50 per cent overload can be comfortably accommodated and carried in the vehicle. The body measures 12 ft. in length, 6 ft. 11 in. in width and 3 ft. in depth. Two loading levels are arranged for, one 4 ft. 9 in. and the other, when the hinged sides are erected, 6 ft. 3 in. The over-all length is 17 ft. 5 in.

Special attention has been given to providing a roomy and comfortable cab that will accommodate five men, including the driver, so that the loaders as well as the driver can travel to and from the depot protected from the weather.

The vehicle has a rated speed of 10 m.p.h. and has a traveling capacity of 30 miles per charge, both being ample for refuse collection work.

Many Advantages of Electric Drive in Ice Plant

SAVING in space, compactness of installation, neatness of operating room and low operating and maintenance costs were the governing factors in the adoption of electric drive and purchased power for the new raw water ice plant of the American Ice Company in Kansas City, shown in the accompanying illustrations. The plant, which has a capacity of 65 tons of ice per day with 300 tons daily storage, is equipped with three York compressors each direct connected to 60-hp., 440-volt, three-phase General Electric synchronous motors. Motors operating brine and circulating pumps bring the total connected load to 345 hp.



COMPRESSOR ROOM AND OUTDOOR SUBSTATION OF AMERICAN ICE COMPANY, KANSAS CITY

Power is supplied from the lines of the Kansas City Power & Light Company through three 100-kva., 2,300/440-volt transformers owned by the customer. As this ice plant is located well within the residential section of the city, central-station service was particularly valuable in permitting design of the building to conform with its surroundings and insuring the absence of smoke or gases, which undoubtedly would have been objectionable if some other form of power supply had been used.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Recent Italian Installations of Self-Acting Siphon Spillways.—GUIDO FERRO.—A number of installations are described and depicted. The older types discharged from 35 to 40 per cent of the water which might ideally flow with the given cross-section and head; in the newest designs this factor has been raised to 70 per cent.—*Engineering* (*England*), Jan. 1, 1926.

Recent Developments at Colfax Station.—CHARLES W. E. CLARKE.—The original installation at Colfax station, put in operation in December, 1920, consisted of one 60,000-kw., three-element turbo-generator unit, equipped with 100,000 sq.ft. of condensing surface in four shells, and the necessary steam-generating equipment. Subsequently a second 60,000-kw. unit was installed, and very recently a third-unit extension was constructed, housing two 35,000-kw. multiple-exhaust turbines. Five 27,680-sq.ft. pulverized-fuel-fired boilers and one stoker-fired boiler constitute the additions to the steam-raising plant. The average heat consumption per kilowatt-hour for the station for the first six months of 1925 was about 17,750 B.t.u. At present precise determinations of results for the third unit by itself cannot be made, but tests show the heat rate at the boiler nozzle to be, for full load, 12,752 B.t.u. per net kilowatt-hour delivered; for three-quarters load, 13,021 B.t.u.; for half load, 14,200 B.t.u. Full readings are given in the paper, the main conditions being: Pressure, 266 lb. to 270 lb.; temperature, 566 deg. to 598 deg.; condenser vacuum, 28.15 in. to 28.35 in.; back pressure in exhaust, 0.99 in. to 1.22 in. in absolute; hot-well temperature, 76 deg. to 83 deg.; discharge from No. 4 heater, 303 deg. to 349 deg.—*Mechanical Engineering*, January, 1926; also (somewhat abbreviated) *Power Plant Engineering*, Feb. 1, 1926.

Generation, Control, Switching and Protection

Columbia Power Station.—The new plant of the Columbia Power Company, about 20 miles west of Cincinnati, has an initial installation of two 45,000 kw. tandem turbo-generators and is designed for an ultimate total of 300,000 kw. Some of the principal features are the use of powdered coal, reheating the steam between the high and low-pressure of cylinders of the turbines up to 725 deg. and preheating the primary combustion air. These and other features are described, and in addition two pages of tabulated data are given regarding the more important elements of the equipment.—*Power Plant Engineering*, Feb. 1, 1926.

General Survey of the High-Tension Switchgear Field.—S. FERGUSON.—The paper goes into its subject in detail in many respects, being 34 pages in length, with numerous figures. It deals first with the evolution of switchgear, giving the contributing factors in its development. Present-day types are scheduled and the principal features compared in the light of the requirements of good switchgear. Various schemes of connections for central stations and substations are considered, and the advantages and disadvantages of different arrangements are summarized. A number of typical installations are shown for superpower stations, including layouts for indoor and outdoor service. The last section contains a critical discussion of oil-immersed breakers.—*Journal I.E.E.* (*British*), December, 1925.

Transmission, Substations and Distribution

Recent Developments in Power Distribution Systems for Street and Interurban Railways.—J. KÖRNER.—A review of the present standard methods in power distribution for street and interurban railways and of the most important features of the converting elements, especially the mercury rectifier. Automatic substations are also discussed.—*Teknisk Tidskrift* (*Swedish*), *Elektroteknik*, Dec. 5, 1925.

Stray Flux and Forces on Transformer Windings.—H. DE PISTOYE.—In a recent French article M. Papin presented formulas for the calculation of forces on concentric transformer windings of either unequal height or eccentric location. The author of this paper maintains that Papin's equations may be considered as purely empirical formulas which are not sufficiently well founded theoretically. Approaching the problem on a strictly mathematical basis, the writer develops equations to calculate the increased voltage drop on eccentric coil stacks. Actual test checks show that for slight development of the coil axis the empiric formula of Papin gives results of greater accuracy, while for more pronounced displacement only the mathematical formula can be applied at all. In addition, the new theoretical equations lead to important conclusions concerning the influence of tapped-out winding sections on transformer stacks of the concentric design. For a given number of taps the most favorable arrangement in the coil stack, electrically and mechanically, can be readily determined by the new method.—*Revue Générale de l'Electricité*, Dec. 19 and Dec. 26, 1925.

Units, Measurements and Instruments

Stroboscopic Slip Measurement.—H. KOHRS.—In spite of the introduction of various direct-reading slip meters, the very simple stroboscopic method is still used quite frequently, because it can be readily improvised at virtually no cost. A paper disk on the end of the motor shaft and any kind of arc lamp will give perfect results when the apparent revolutions of the cross on the disk are counted with the aid of a watch. The method does not lend itself to a very large amount of slip, because it is difficult to count the rapid revolutions of the cross in that case. The author suggests superimposing a direct current upon the alternating current which feeds the arc light, thus reducing the speed of apparent revolutions to one-half. Specially suitable cross designs are given for disks, for motor speeds from 250 r.p.m. to 3,000 r.p.m.—*Elektrotechnische Zeitschrift*, Dec. 31, 1925.

Tentative Directions for the Determination of the Electric Strength of Solid Dielectrics.—(Report received from the British Electrical and Allied Industries Research Association.) These specifications cover first the forms in which the material may be tested, preparation of material previous to test, conditioning the material, and method of heating or cooling the specimen after conditioning and previous to carrying out the electric strength test. A single value for electric strength of most materials is misleading unless the condition, the thickness, time of application of the voltage and temperature are stated or clearly indicated. Methods are described for obtaining a gradual rather than a sudden application of voltage. In the case of materials in the form of a flat sheet, having an electric strength greater than 1,200 volts per mil, it is not practicable to have the test applied to a thickness exceeding 20 mils to 40 mils. If the sample is machinable, spherical recesses are to be cut to receive spherical electrodes. Diagrams are shown for suitable roughing and finishing tools for making such recesses. In molded material they are to be formed in the sample, leaving a thickness of 20 mils. This method is not recommended for electrically weaker material. Other directions relate to wires, compounds, breakdown along laminas and radio-frequency tests. A series of appendices contains tables for conditioning, thickness and period of application and factors connecting the maximum with the mean stress. Reference should also be made to the tables of sphere-gap spark-over voltages for various diameters up to 500 mm., and corrections for variations in relative humidity and air density, as well as to diagrams and descriptions of apparatus to be used in testing.—*Journal I.E.E.* (*British*), January, 1926.

Illumination

Stage Lighting.—A. L. POWELL and THEODORE FUCHS.—The present 48-page bulletin is confined chiefly to certain means for securing lighting effects. Attention is called to some fundamental principles—scrupulous avoidance of glare, careful concealment of sources, "painting" sky, cloud and landscape by means of projecting lanterns on a white cupola instead of the fixed backdrop formerly employed. Noteworthy improvements have been made in foot and border lights, including the use of individual lamp reflectors, separate housings, small spotlamps, semi-diffuse reflecting surfaces and provision for preventing the presence of undesired colors caused by filtration of light through adjacent unlighted lamps of another hue. Another section of the bulletin is devoted to switchboard, wiring and dimmers. For the general practitioner in illumination the section of amateur productions will be of par-

ticular interest. It includes comments on simple applications of principles and methods used on the regular stage as well as suggestions for the production of various scenic effects with a minimum of equipment. Colored light is having so many applications these days elsewhere than on the stage that the accompanying table, showing the approximate wattage required to produce the same illumination with different colors, should be of wide usefulness.

COMPARATIVE DATA ON WATTAGE FOR STAGE LIGHTING

Ordinary Designation	Absorption, Per Cent	Transmission, Per Cent	Wattage to Produce Same Illumination
White (unmodified)..	.....	.....	100
Amber.....	30–60	40–70	150– 250
Red.....	75–85	15–25	400– 750
Green.....	80–90	10–20	500–1,000
Blue.....	90–95	5–10	1,000–2,000

The absorption factors apply to the light from "Mazda" lamps and are necessarily subject to considerable variation, depending on the purity of color secured, thickness of color media employed and other factors.—*Bulletin LD 146A, Edison Lamp Works.*

Motors and Control

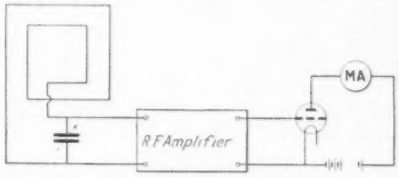
A Criterion for the Sensitivity of the Armature Windings to Variations in the Commutating Field.—L. DREYFUS.—The conditions of commutation in a commutator machine are usually considered in the light of the reactance voltage, computed on the assumption of straight-line commutation. The reactance voltage is usually put proportional to the stator current and the number of commutating conductors per slot and inversely proportional to the commutating period per coil. This gives a workable method for the dimensioning of the interpole windings, but furnishes no aid in judging the conditions of commutation when the fundamental supposition of the magnitude and the distribution of the interpole field are incorrect. The author proposes a method for establishing a criterion for best commutation and develops mathematical expressions for comparing the influence upon the commutating conditions of the various factors involved. The theory is applied in detail to a machine with an even number of slots per pole, an arbitrary number of conductors per slot and a chording of less than one slot pitch. The results indicate that cases of very difficult commutating conditions can be improved by using the fractional pitch chording ("step coils"). The paper gives a complete bibliography of the subject. — *Teknisk Tidskrift (Swedish), Elektroteknik,* Oct. 3 and Dec. 5, 1925.

Electrophysics, Electrochemistry and Batteries

Peculiar Dielectric Tests.—W. H. BRÜCKMAN-PIJL. — In the course of other research work in a high-voltage laboratory, the authors made three experiments, with results for which no ready explanation seems available. Measuring the loss angle on an air condenser with a Schering high-voltage bridge, uncertain results were obtained varying between 0 and 5 per cent. It seems that a co-called "lossless" condenser is really without losses only if dielectric stray fields are carefully avoided. It was found also that cable compound, which is insoluble in oil, dissolves therein under electric stress, and that the colloidal solution of the compound in the oil has the same dielectric strength as oil, although the compound tested twice as high as the oil. It was found in the third instance that when cable paper is tested between electrodes in the same way as cable compound it will be slightly carbonized at the points where the edge of the electrode recedes from the paper. The authors believe that these peculiar experiments may help to enlarge knowledge of the properties of dielectric materials.—*Elektrotechnische Zeitschrift,* Jan. 7, 1926.

Telegraphy, Telephony, Radio and Signals

New Method of Directional Control.—PAUL D. TYERS.—Attempts to control the path of moving bodies such as airplanes or ships by wireless telegraphy have heretofore consisted essentially either in transmitting bearings to the moving object or taking bearings from the moving object on some fixed station. Both of these methods have required the services of skilled operators. To obviate this necessity a scheme has been worked out to utilize the transmis-



CIRCUIT SCHEME FOR CONTROL OF MOVING BODIES

sion directly to control some form of indicating device. A unidirectional receiver, represented by the loop in the figure, is turned so that its plane is at right angles to the line connecting it with the sending station. This is connected, through a rectifier, to an amplifier system and milliammeter. Practically no voltage will then be impressed upon the grid of the amplifier, and a certain normal current will flow through the milliammeter. The dial of the latter can be rotated so that its zero can be made to coincide with the position of the pointer. If now the vessel carrying the device turns somewhat, an emf. is impressed upon the grid and the current through the instrument changes. It is not evident from the description that the instrument shows in any way whether the deviation has been to the right or to the left. Instead of the loop the author mentions the possibility of a more definitely unidirectional device.—*Electrician (England),* Jan. 8, 1926.

Short-Wave Developments.—Some details are given on recent American experiments, from which it appears that wave lengths of 100 m. permitted good communication at certain times during the hours of darkness, but gave totally unreliable service in the daytime. Below 50 m. the night signals became weaker, but service could be maintained during daylight hours. The range between 15 m. and 30 m. was unsatisfactory. The conclusion was that 40 m. was the best for practical use at all hours of the day. Types of radiators were finally reduced to three —the straight vertical antenna oscillating at harmonic frequency, the horizontal antenna with an over-all dimension of one-half wave, fed at the center, and the series tuned horizontal loop. These all have one property in common, that the radiation is projected at a high angle upward.—*Electrician (England),* Jan. 8, 1926.

Traction

Starting Conditions in Motor Cars.—O. MALMER.—A review of a series of experiments made by the street railways of Gothenburg, Sweden, with the object of reducing the loss of energy encountered in the acceleration and deceleration of the trains. — *Teknisk Tidskrift (Swedish), Elektroteknik,* Dec. 5, 1925.

Measurement of Stray Currents.—C. MICHALKE.—Unless the rails of direct-current railways are perfectly bonded, stray currents may start underground from the rails, causing the electrolytic destruction of metallic pipe lines. The maintenance of trolley trackage makes it necessary to measure at intervals any possible stray currents due to faulty bonds. It also may become necessary in settling a legal suit based on alleged electrolytic corrosion to submit exact data of stray current conditions at the location involved. In this article the author presents various methods of measuring stray currents with the highest degree of accuracy. Mathematical explanations are given for each method recommended, and in some cases tabulated data show the magnitude of stray currents for varying distances between rail and pipe line. Of interest are the described nonpolarizing electrodes for measurement in cases where the counter-emf. from a metallic ground electrode may introduce too large an error.—*Elektrotechnische Zeitschrift,* Jan. 7, 1926.

Miscellaneous

Forty-Year Transformer Anniversary. — M. REITHOFFER. — The author recalls an installation made in Vienna in 1885 wherein 1,100-volt single-phase current was transmitted a distance of about half a mile and where for the first time in history transformers were used to step the incoming energy down to feed 202 Swan incandescent lamps. The transformers were designed and built by Déri, Zipernowsky and Bláthy and are asserted to be the first transformers ever used. In 1884 Goulard and Gibbs received a prize in Turin for their "secondary generators," which were induction apparatus connected in series into a high-voltage line. Great difficulties were encountered to keep the secondary voltage of these machines constant for varying load, a problem which was readily solved for Déri's transformers. It is also claimed that the word "transformer" was coined by the above-named engineers.—*Elektrotechnik und Maschinenbau,* Dec. 20, 1925.

Scientific & Industrial Research

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Ventilation of Turbo-Alternators, Study of, on Models

During the year this pioneer work has been carried forward to a very satisfactory conclusion by the use of small models. Previous calculations and empirical formulas have been checked so that now a complete solution of the complex problem of measuring static pressures in a fluid moving at considerable velocity can be successfully obtained.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.* [See a paper by Fechheimer and Penney, before the 1926 A.I.E.E. midwinter convention.—EDITOR.]

Switchboards of Sheet Steel

A development of importance to powerhouse and switchboard practice is the introduction of the sheet-steel switchboard which seems destined largely to supersede the present slate and marble panels. Lightness, durability, strength and excellent appearance are some of its qualities. Each panel with its frame is made of one piece of sheet steel with corners suitably turned and welded and is assembled at the factory complete with instruments and other apparatus mounted, wired and tested.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Control, Magnetic, Time-Element

A time-element magnetic control has been brought out for use with direct-current motors. Definite time between the closure of successive accelerating contactors is secured by relays which have a lag in their operation, due to the self-inductance of a short-circuited coil.—*General Electric Company, Schenectady, N. Y.*

Refrigeration, Electric

An electric refrigerator has been developed in which the mechanism is totally inclosed, is practically silent in operation and requires no attention for lubrication. This machine is a departure from conventional lines in that all the refrigerating mechanism is contained in one integral unit, one part of which sets into the brine tank through the top of the cabinet. The motor compressor and all moving parts are hermetically sealed in a case containing the refrigerant and lubricating oil.—*General Electric Company, Schenectady, N. Y.*

Carrier-Current Telephony, Intersystem Operation of

By intersystem operation is meant service between dispatchers of different systems. On each system the carrier communication is normal with other sets on the same system frequency. Dispatchers who desire to communicate from two adjacent systems, however, may make provisions for doing so by the addition of an intersystem attachment; this makes it possible for them automatically to communicate on an intersystem frequency which differs from either system frequency. Intersystem communication is very much simplified by the use of single-frequency duplex, since a total of only three frequencies, instead of six, is necessary.—*General Electric Company, Schenectady, N. Y.*

Synchronous Condenser, with Voltage Regulator

A synchronous-condenser installation, rated at 1,000 kva., for the Otter Tail Power Company is provided with a voltage regulator and starts and stops on voltage indication. It is installed at the end of a long transmission line and is arranged to remain on the starting tap on complete power failure. Reactance is thus provided as a line protection when power is restored.—*General Electric Co., Schenectady, N. Y.*

Carrier-Current Telephony, Connecting Line for

High-frequency transmission-line tuning equipment has been designed for the purpose of connecting the carrier set with the high-tension coupling equipment which may be a mile or so away. By this means efficient coupling may be insured, even though it is necessary to install the set at a distance from the power transmission line.—*General Electric Company, Schenectady, N. Y.*

Welding in Hydrogen

New methods and apparatus for welding in hydrogen and other gases, using the electric arc, have been devised. By this means strong and ductile welds can be made even with materials such as high-chrome alloys which are not otherwise weldable.—*General Electric Company, Schenectady, N. Y.*

In Progress or Purposed

Insulation for Turbo-Alternators

Experimental work is being carried on toward the improvement of the insulation for turbo-generators. Micarta channels for the end turns and a micarta lining for the retaining rings have been successfully developed. A life test has been run on a model to show the effects of expansion and contraction of the coils on this material. Twelve hundred complete cycles of heating and cooling have been carried out, which is approximately equivalent to 20 years' service on the basis that units would be started up and shut down once a week. No apparent wear of the insulating material has been found.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Distribution, Electrical Problems of

Our sub-committee's report includes a description, with advantages and disadvantages, of various types of primary and secondary distribution systems, together with the electrical problems incident to such systems. The report covers the use of common and separate neutral wires for the primary and secondary systems, the use of fuse protection, multiple operation, operation of transformers, emergency supply during periods of interruption, and secondary network systems.—*Overhead Systems Committee of N. E. L. A.*

Insulator Research

A sub-committee has been carrying on its investigations at Stanford University and the California Institute of Technology upon factors which affect the life of suspension-type insulators, including vibration, moisture and temperature. It is also investigating the effect of various types of cement and methods of cementing as related to the life of these insulators.—*Overhead Systems Committee of N. E. L. A.*

Dielectric Loss and Ionization in Paper

The work on dielectric loss and ionization is progressing. The nature of the investigation requires a more accurate method of determining dielectric loss than is necessary for the usual factory tests, and the indications are that a more accurate method of measuring dielectric loss will be evolved as a result of these investigations.—*Harvard Engineering School, Cambridge, Mass.*

Cables, Thermal Resistivity of Paper for

Some investigations on the thermal resistivity of impregnated paper insulation are in progress. While this property of the insulation is not of serious importance with the thinner insulation for the lower voltages, it becomes quite important in connection with cables for the higher voltages which are now being considered by a number of companies. The same investigation will include some data on the emissivity of the lead sheath.—*University of Wisconsin, Madison, Wis.*

Paper, Impregnated, Maximum Temperature for

The investigation to determine the maximum permissible operating temperature of impregnated paper insulation, when no dielectric stresses are involved, is being continued. The results of the preliminary tests already reported have been thoroughly analyzed and digested, and the final tests for determining the desired results have been started. As soon as these tests are under way there will then be started the preliminary work in connection with a similar investigation to determine the maximum permissible operating temperature when the insulation is at the same time subjected to dielectric stresses.—*Massachusetts Institution of Technology, Cambridge, Mass.*

Seconds Signal, Through Photo-Electric Cell

A 1,000-lumen street lamp having a short vertical filament of high candlepower is used. By means of a lense a beam of light from this source can be focussed on a photo-electric cell, giving a vertical line image only a little more than ¼ in. wide. The pendulum in cutting the beam of light produces a sharp action on the cell. The current from the cell, amplified by means of two radio tubes in parallel, operates a special relay which transmits the signal.—*Bureau of Standards, Washington, D. C.*

Welding, Pressure Vessel Investigations

The welding industry, through the American Bureau of Welding, will shortly undertake a comprehensive series of investigations to obtain information and data which will be of assistance in bringing about revisions and enlargements in the present A. S. M. E. Code on the welding of unfired pressure vessels and in assisting tank manufacturers in their design work.

Suggestions for Research

Hydraulic Turbine Runner, Pitting of

Research is needed along two lines: (a) In the laboratory, where it may be possible to reproduce the pitting process at an accelerated rate and to make comparative experiments as to the metals which best resist pitting, and (b) in the field, where different metals can be applied on the same vanes of a wheel and in the course of a year or two produce authoritative data. Many companies are now at work along these lines, but there is a special need for laboratory research work.—*Albion Davis, Keokuk, Iowa.*

Cables, High-Tension, Test Terminal for

The problem of a thoroughly satisfactory temporary test terminal has not yet been solved. As pointed out in the report of last year, such a terminal is one which will always insure puncture taking place well within the ends of the lead and which can be applied to the test sample at a reasonable cost.—*Underground Systems Committee of N. E. L. A.*

Cables, Ratio of Direct to Alternating Test Voltage

Despite the increasing number of kenotron high voltage sets being put into service by operating companies and the experimental work which has been done during the year by manufacturers and others, sufficient data are not yet available to enable the committee to make definite recommendations on this question. In other words, the situation is about the same as reported last year, so far as the final value of this factor is concerned.—*Underground Systems Committee of N. E. L. A.*

Thorium, Uses for

New methods have been developed for commercial production of rare metals, such as thorium, zirconium, etc. Thorium is a soft ductile metal which can be cold-worked into rods, sheets and wire. Owing to its high atomic weight and the high purity with which it can now be produced, it has superior properties for X-ray targets. It is desired to investigate other practical uses for it.

News of the Industry

N.E.L.A. Technical Meeting

Good Attendance at Kansas City Last Week—Chairman C. F. Hirshfeld Tells of New Committee

DESPITE the unfortunate coincidence in time of the midwinter convention of the A. I. E. E. in New York City and the meetings of the Technical National Section committees of the N. E. L. A. in Kansas City last week, the latter were surprisingly well attended, in the opinion of committee chairmen, some of whom reported record attendance. Four days were devoted to meetings—the first two to the committees on electrical apparatus, inductive co-ordination, meters and prime movers and the last two to the committees on accident prevention, hydraulic power, overhead systems and underground systems. This arrangement was followed to enable individuals to attend the meetings of more than one committee. Between the two groups of meetings were held the executive committee meeting and general meeting and dinner.

The growing and vigilantly nurtured desire to co-ordinate the national committee activities with the divisional committees, to make committee information available through serial reports instead of delayed convention reports, to plan more than one year ahead and take up topics in order of their importance, to prevent interruptions of work between administrations and to economize in expense without sacrificing benefits was everywhere manifest.

Chairman C. F. Hirshfeld expressed the general attitude when he said: "The Technical National Section is organized on a national basis and is effective in the solution of nationally important problems only so long as it acts on such a basis. We are continually studying our methods of operation for the purpose of discovering things leading to excessive cost or waste of time and are now actively engaged in such modifications of our methods as are necessary to reduce our costs to a minimum. I am satisfied that within the next two years a very marked improvement in this respect will be obvious to all.

"If we are to remain a nationally active organization," Mr. Hirshfeld continued, "it is necessary that we not only retain the interest of all member companies, irrespective of where they may be located geographically, but that we also give their representatives a reasonable opportunity to participate in our activities. I am convinced that this can be done only by holding successive meetings of our section in widely scattered and strategically located geographical centers. We have reduced the number of our group meetings to two per year in order that they shall not be unduly burdensome either in money or time and we have adopted the idea of holding these two in widely separated centers. It is not entirely correct to regard the attendance of committeemen as promoting only the interest and work of the Technical Section of the N. E. L. A. They cannot help but profit personally through their contact with men from other sections of the country and from the things which they will see, and they should be able to bring back to their respective companies more than enough to offset the cost of their traveling plus the money value of their absence."

Announcement of the establishment of a Technical Section engineering administration committee was made by Mr. Hirshfeld. This committee, which is one of the moves intended to make the section of maximum value in the broad engineering field that embraces economics as well as technology, is meant to afford a closer tie between the technical and executive branches of the utility business, to serve as a co-ordinator of technical activities and to perform functions of engineering administrative value that are not within the scope of any of the eight existing technical committees. Consideration of operating budgets, their formation and method of application is one example of the type of subject in mind for the committee to consider. Its personnel has not been completed, but it will consist of five members. One of the vice-chairmen of the Technical National Section will be chairman.

Detroit Edison Ready to Cut Residential Rates

The Detroit Edison Company has asked the Michigan Public Utilities Commission to permit it to make a voluntary reduction in its residential lighting rates. The new rate proposed will embody a reduction from 12 cents per kilowatt-hour for the first step to 10 cents. Additional consumption will remain as heretofore at 4 cents per kilowatt-hour. A company executive said, in explanation of the contemplated reduction:

"The company finds itself able to make this cut because of a general improvement in conditions in all its departments and the general outlook for continued improvement, including the stable condition of coal prices, one of the principal items of our operating expenditures."

Senate to Take Up Muscle Shoals Monday

House Resolution Will Be Considered Then, Although Committee Still Conducts Hearings — Senator Ransdell Introduces a Bill — Other Washington Topics

BY PAUL WOOTON
Washington Correspondent of the ELECTRICAL WORLD

THE steering committee of the Senate has arranged for the consideration on Monday, Feb. 22, of the House resolution providing for a joint congressional committee to receive bids for a lease of the Muscle Shoals properties. Notwithstanding this, hearings on Muscle Shoals legislation began again before the Senate committee on agriculture on Feb. 17. Ralph Crisswell of Los Angeles appeared on that date and presented his views on the advantages of public ownership.

Senator Ransdell's Bill

With the idea of requiring the distribution of Muscle Shoals power throughout "the full radius of its economic use," Senator Ransdell of Louisiana, a member of the committee having jurisdiction in the Muscle Shoals matter, has introduced a bill providing for the allocation of all power by the Federal Power Commission and the transfer to that agency of all the government's Muscle Shoals properties. The power is to be leased only for public utility purposes, although provision is made for the local use of such power as may be necessary to conduct experiments in nitrogen fixation, with other fertilizer ingredients and with electrochemical and electrometallurgical processes where power is essential.

In introductory "whereases" Senator Ransdell makes it clear that he does not believe the government should go into the power business or the fertilizer business. He makes the point that while "it is the duty of the government to foster beneficial arts and sciences, it also is the duty of the government to refrain from engaging in competitive business in which its citizens are engaged." He thinks, however, the government can contribute greatly to the welfare of the farmers by doing research work on fertilizers at Muscle Shoals. He points out that there still is much to learn concerning the art of nitrogen fixation and concerning the manufacture of other fertilizer ingredients. His bill provides that private inventors and investigators of these processes may have an opportunity to work out their ideas at Muscle Shoals, where the government will supply them with the necessary facilities. When the best method of manufacturing nitrogen shall have been developed and when it shall have been demonstrated that synthetic nitrogen can be produced at a cost which will allow it to compete with Chilean saltpeter, private enterprise will be willing, he believes, to

lease the nitrate plant at Muscle Shoals without demanding a subsidy in the form of power. The bill also provides for experimentation on the part of the War Department and the Agricultural Department, the agencies concerned principally with nitrogen fixation.

Senator Ransdell took an important part in the defeat of the Ford offer. He is opposed to the House resolution, now on the Senate calendar, because it holds up the Ford offer as a model to the proposed joint congressional committee and because it does not provide for the distribution of any power not actually required for the manufacture of fertilizer.

Senator McKellar of Tennessee has introduced a bill providing for government operation and that power generated shall be distributed to states, counties and cities on a preferential basis, but that surplus power can be sold to the distributing power companies for industrial uses and also direct to consumers if there are no distributing companies. The measure also provides for manufacturing fertilizer.

Federal Power Commission Again Appeals for Personnel

In a letter to the Director of the Budget the three Cabinet members composing the Federal Power Commission have set forth in detail why they believe that the commission should be allowed to employ its own personnel and should have direct appropriations for all of its activities. In addition, it is pointed out that the commission should have the authority to reimburse other departments or the Treasury for co-operative work, particularly for field work. A plea also is made for permission to segregate receipts for appropriation for the work of the commission. The letter declares:

"The existing arrangement is unsatisfactory from the standpoint of a businesslike conduct of the commission's activities. So long as the costs of doing its work are covered up in a multitude of appropriations other than its own and its receipts are likewise obscured and scattered as the act now provides, there can be no intelligent budgeting and no businesslike appraisal of the work of the commission."

Utilities and Federal Courts

The judiciary committee of the House has no plan at present for taking up the Dickstein bill and other bills proposing to limit the jurisdiction of United States courts in cases involving the rates and other charges in public utility cases. Similar legislation was offered at the last Congress and hearings were held. It was so evident at that time that the committee did not regard the proposal favorably that no formal vote on the bill then under consideration was taken. As there is no reason to believe that sentiment toward such legislation has changed, it seems probable that the committee will not be disposed to take up time with further hearings.

Financial Plans for Conowingo Project

Susquehanna Power Company Lays Them Before Maryland and Federal Power Commissions—Ritchie Again Indorses Undertaking, but Pinchot Attacks Plan

PLANS for financing and operating the Conowingo power project were laid before the Maryland Public Service Commission and the Federal Power Commission at Baltimore on Feb. 12. Three applications from the Susquehanna Power Company were heard. No action was taken by either commission at the time, but full approval is expected to follow. Friday of this week was set as the tentative date for a conference between the Maryland, Pennsylvania and Federal Power commissions.

At the hearings John A. McKenna, secretary and treasurer of the Susquehanna Power Company, and Walter E. Long, comptroller of the Philadelphia Electric Company, testified as to the authenticity of the financial statements of the two companies submitted as exhibits in the applications. Other witnesses were Norwood P. Halowell, of the Lee, Higginson Company, investment bankers of New York, Boston and Chicago, and Robert K. Cassatt, of Cassatt & Company, Philadelphia and New York bankers. They testified that the bonds should sell to the ultimate investor at 98 to 100, that bankers, should realize from 4½ to 6 per cent and that the bonds would net the company from 92 to 95½.

Under one of the applications before the two commissions the Susquehanna Power Company seeks permission to transfer on its books 245,500 issued and outstanding shares of common stock to the Philadelphia Electric Company, to sell 24,500 shares of authorized class A common stock without par value at $20 a share, and to execute a mortgage with the Philadelphia company to obtain a bond issue for $38,000,000. The other two petitions involve the lease of property owned by the Susquehanna Power Company to the Susquehanna Electric Company and an agreement between the Susquehanna Power Company and the Philadelphia Electric Company relative to maintenance of the lake which will be formed by the dam.

Two Governors Give Views

In replying to censor from the executive board of the Maryland State and District of Columbia Federation of Labor, Governor Ritchie of Maryland has restated the reasons why, in his opinion, the only possible way to develop the Conowingo water power was by corporate enterprise and in the manner now proposed. "State ownership," the Governor said, "is, in my judgment, out of the question, because, among other reasons, it would practically triple the public debt of the state."

Governor Pinchot of Pennsylvania, however, has sent a letter of protest to the Federal Power Commission in which he asks that body to refuse any application for issuance of non-voting stock or stock above the amount actually needed to finance the construction of the project. Governor Pinchot said his protest was necessary because Pennsylvania laws fail to empower the state commission to regulate the issue of securities, leaving "the only protection of our people in this case" with the Federal Power Commission.

The Governor points out that the proposed issue of $38,000,000 in bonds and $16,000,000 in preferred stock will provide the $54,000,000 estimated as necessary to pay the cost of the project. He declares that an additional 91,200 shares of common stock for the issuance of which permission is asked "can serve no purpose but that very speculation in unearned increment which the federal water-power act was intended to prevent."

Conference on Cost of Wiring to Be Held in March

The wiring committee of the National Electric Light Association, meeting in New York on Monday, approved plans for the calling of a joint conference on the cost of wiring, three men to be appointed by this committee and three men each invited to represent the manufacturing and the contracting branches of the industry, the purpose being to discuss the difference of opinion which has arisen over the all-metal standard advocated by the Association of Electragists and determine the best course to be followed for the encouragement of more complete wiring installations. This conference is expected to be called for some time in March.

S. E. Doane, as chairman of a special sub-committee, submitted a classification and analysis of the purposes of the National Electrical Code, recommended for publication as a preface to the code and a guide to its interpretation, which the press was requested to publish for the consideration of the industry. The committee voted approval in principle of the uniform electrical ordinance which has been developed by the Electrical Manufacturers' Council, "to be used as a guide for member companies that may be concerned in the development of local ordinances," and a committee comprising A. A. Pope (chairman), R. S. Hale and C. A. Bates was appointed to cooperate with the manufacturers in working out certain recommended changes.

The committee discussed at length the need for some influence to keep household appliances consuming 1,000 watts or more from being connected to lamp sockets. R. S. Hale submitted a brief on the subject recommending that the manufacturer be requested to equip such heavy appliances with plug caps having tandem blades, so they would fit into any standard convenience outlet but could not be easily used in a socket.

Victor Tousley was appointed chairman of a committee to study the possibility of a simpler basis for the regulation of branch circuit capacities. This is the last meeting of the wiring committee to be held before the national convention. A. P. Good is chairman.

Group Management Is Benefit to Customers, Voorhis Says

Warren R. Voorhis, vice-president of the American Water Works & Electric Company, in a speech before the St. Louis Electrical Board of Trade on Tuesday discussed the benefits of group management of public utility properties, largely from the standpoint of the customer. Mr. Voorhis emphasized the fact that the services rendered by the holding company and paid for by its operating subsidiaries are not an added burden to the customer of the operating company, but, on the contrary, the cost of the service to the consumer is reduced by the economies and efficiencies of group management.

"It is important to the ratepaper living in a small city and served by comparatively a small utility that his company have the benefits of sound engineering, capable financing and the best management. These essentials must be given from some source," said Mr. Voorhis. "The assistance which the holding company can and does render to its operating subsidiaries is available all the time and to each utility, no matter how small, and at an inconsiderable cost, whereas the occasional services of high-grade talent required by the independent company command large and in many instances prohibitive fees."

Mr. Voorhis specified the purchasing department of the holding company, with its wide knowledge of markets and market conditions; the holding company's constant studies of economics and efficiencies, its employment of a staff of engineers of experience and ability and its financial service in raising capital and advancing cash as services which all redound to the benefit of the local customers.

Eastern Electrical Inspectors' First Annual Meeting

The Eastern Association of Electrical Inspectors held its first annual meeting on Wednesday, Feb. 10, in the Hartford Electric Light Company's hall at Hartford, Conn. While many members were prevented from attending by a severe snowstorm, the gathering was an enthusiastic one and some interesting discussions followed the papers presented. The morning session was taken up by a discussion of the National Electrical Code grounding requirements, led by Dr. M. G. Lloyd of the Bureau of Standards. In the afternoon, after a short business meeting, Harry B. Kirkland of the Society for Electrical Development spoke on the uniform electrical ordinance. Following this paper Earl E. Whitehorne, commercial editor of the ELECTRICAL WORLD, dealt with the attitude of the electrical industry toward the electrical inspector.

The Eastern Association of Electrical Inspectors is the outgrowth of the Western New England Association of Electrical Inspectors, which has been active in its territory for many years under the leadership of Thomas Henry Day of Hartford. A few months ago the organization expanded, and under its present name the Eastern association has an enrollment of between 400 and 500 members.

The object of the association is to promote a uniform interpretation and enforcement of the National Electrical Code, to secure a better and more uniform standard of electrical construction and to disseminate information and correct practice among its members. The headquarters are at room 1100, 123 William Street, New York, and the officers are as follows: President, J. C. Forsyth; vice-presidents, W. C. Field, J. C. Rohan and R. M. Nesbitt; treasurer, A. W. Hopkins; secretary, E. P. Slack.

Local chapters have already been formed in Philadelphia, New York and Connecticut, and a number of committees have been organized. The members believe that this organization will be an active force in obtaining improved and more uniform electrical installations.

Attacks Applicants for State Power

Governor Smith of New York Asks Who Are Behind the Would-Be Lessees of St. Lawrence and Niagara Sites—Attorney-General Thinks This Not the Issue

A VIGOROUS attack on Governor Smith's water-power policy by Representative O. L. Mills, who called it socialistic, and a statement issued by the Governor in reply to the stand taken by Attorney-General Ottinger have been the chief late incidents in the political battle over hydro-electric development in New York State. The Governor attacked the Louisville Power Corporation, applicant for water from the St. Lawrence River in the vicinity of Croil Island, where 500,000 hp. is available. This company, the Governor said, had a capital stock of only $20,000 and its papers of incorporation do not mention the location of its principal office. Its three nominal directors, residents of Louisville, N. Y., and Massena, N. Y., are, he implied, unknown in the worlds of power and finance.

It is equally unknown, the Governor said, who is behind the St. Lawrence Valley Power Corporation, which, with headquarters at Potsdam, is applying for a site at the Long Sault Rapids, where another 500,000 hp. is available. Concerning the third company involved, the Lower Niagara Power & Water Supply Company, to which has been offered a preliminary permit for 150,000 hp. from the Niagara Gorge, the Governor said:

"This company was brought into existence twenty-four years ago by a special charter, with its principal office at Lewiston, N. Y. According to the records in the office of the Secretary of State, the seven directors did not state their places of residence and the question again arises who really owns the Lower Niagara Power & Water Supply Company and what is its financial responsibility to undertake a thirty-million-dollar improvement in the Gorge at Niagara Falls? A reading of the old charter puts it in the class of general grants that were made years ago, wherein power is given to this company to condemn private property except that used for railroad purposes, for the laying of conduits, pipe lines, wires and various other appliances required in its business. Who knows but that this grant may put life and vitality into an old-time charter that in the enlightened age in which we are living today would never be granted?"

Attorney-General Ottinger issued a reply to the Governor in which he said in part:

"Under the existing law, public ownership is guaranteed and the Water Power Commission is powerless to surrender one drop of water permanently to any individual or corporation. It should be always remembered that there is constant public ownership of these water powers. They are leased under the rigid supervision of the Public Service Commission for the benefit of the people. The water-power law itself provides that the commission must be absolutely assured of the financial stability of the company undertaking to act under a license. Furthermore, I do not see what difference it makes who is behind the particular company making the application, provided it is legally constituted and has sufficient financial ability to construct the works.

"The Governor is correct in stating that some of the companies that have made applications for licenses to the Water Power Commission were granted charters by the Legislature years ago which purport to give them the rights which they now are seeking. It has been the policy of the commission in situations like this to secure adequate revenue for the state by inducing these companies to submit to its jurisdiction; otherwise, the companies might claim that under the old legislative grants they had the complete authority to use the state's waters without paying anything for the privilege. The Water Power Commission is to be commended, not condemned, for obtaining revenue from these companies instead of indulging in litigation."

A sidelight on the controversy is afforded by a half-page advertisement printed in an Albany newspaper as "written and paid for by two citizens interested in state water-power development." The advertisement, headed "Private Monopoly of Water Power Versus Public Control," gives a summary of achievements and rates ascribed to the Ontario Hydro-Electric Power Commission and calls on the people generally to write to their assemblymen and senators to vote for the power authority bill now before the Legislature.

Another angle to the water-power situation is the alleged willingness of certain power interests to favor development at the expense of the state, provided that they could purchase the electricity so developed at the busbar and that the state would not attempt to make present privately owned transmission lines common carriers for distribution purposes.

A meeting of the Water Power Commission has been called for Feb. 25.

New Mexico Men Assemble

Record Convention at Albuquerque — Association Broadened to Take in All Utilities

MEETING at the Franciscan Hotel, Albuquerque, on Feb. 15 to 17, the annual convention of the New Mexico Electrical Association was by far the largest and most successful yet held. K. W. Kissick, president of the association, outlined the problems of the smaller utilities in its territory and emphasized the importance of continuing the work of building better public relations. Papers and discussion for the most part dealt with the two major problems of the industry, load building and public relations. One rather novel suggestion for creating better customer relations was the use of a credit card which could be handed to a desirable customer moving out of a particular company's territory. The advocates of the plan hope to get all central-station companies in New Mexico, Colorado and Wyoming to issue such cards, which at the option of the recipient company would be accepted as establishing credit.

OVERCOMING PUBLIC PREJUDICE

It was maintained by E. A. Phinney, Jefferson County Power & Light Company, Golden, Col., that the accounting and credit departments are the most influential in developing good public relations. George E. Lewis, director of the Rocky Mountain Committee of Public Utility Information, expressed the belief that most people are simply prejudiced against utilities rather than have any real grievance. Newspaper advertising and publicity he thought two of the most effective means of overcoming such prejudice. Demands have been so great on the speakers trained in the committee's public-speaking college that it has been impossible to accept all invitations extended to these men to appear before public meetings.

J. J. Cooper, president of the Mountain Electric Company of Denver, who is also interested in utility operations, said that it is necessary to work "from within out" on the public relations problem. "Educate your employees to an extent where they feel that they own the company," he said, "and then you will get somewhere on public relations, and when you talk to the public talk in their language and not in technical terms." In the opinion of the same speaker one of the big problems before the industry is to develop the minimum customer so that his business will be profitable to the central station.

E. F. Stone, Southern Colorado Power Company, Pueblo, believed that the electric range has been the greatest single factor in solving the problem of the minimum customer, because it has accustomed him to greater consumption and larger bills and to making larger capital investments for labor-saving devices in the home. In his opinion the electric range had paved the way for electric refrigeration and other appliances.

How the Commercial Section of the Rocky Mountain Geographic Division, N. E. L. A., is conducting its year's task of increasing the use of appliances in the home was discussed by J. A. Clay, Western Colorado Power Company, Durango. An interesting paper on oil development in New Mexico was given by Frank Schram of Roswell, N. M., and another on the cotton industry in the Southwest was given by R. K. Banner of Las Cruces, N. M.

The final business session of the convention was held at Jemez Hot Springs, 65 miles northwest of Albuquerque, where the entire convention had a one-day outing. Here the delegates were afforded an unusual opportunity to witness Indian dances by Indians from the Jemez Pueblo reservation. Resolutions were passed at the business session changing the name of the association to the New Mexico Utilities Association to cover more fully the activities of the organization. All public service companies, whether electric, water, gas, telephone, bus or street railway, will be eligible to participation in the new association.

Officers elected were: President, Frank Schram, Southwestern Public Service Company of Roswell, N. M.; first vice-president, J. B. Ledlie, Mesilla Valley Electric Company, Las Cruces, N. M.; second vice-president, D. E. Bent, Tucumcari Light & Power Company, Tucumcari, N. M.; secretary-treasurer, B. L. Wiles, Albuquerque Gas & Electric Company, Albuquerque, N. M.

Power-Plant Problems Before Canadian Institute

Three papers of special electrical interest were presented at one professional session of the fortieth annual meeting of the Engineering Institute of Canada, held Jan. 27-29 at Toronto. These papers were: "The Trend of Steam Power-Plant Development," by Prof. A. G. Christie of Johns Hopkins University; "Generation by Explosive Gases in Electric Water Heaters and Boilers Operating on Alternating Current with Submerged Electrodes," by Prof. J. W. Shipley, University of Manitoba, and A. Blackie of the National Testing Laboratories at Winnipeg, and "European Engineering Practice with Special Reference to Production, Transmission and Use of Electrical Energy," by A. E. Davison, transmission engineer of the Hydro-Electric Power Commission of Ontario. A session on fuel discussed papers by L. R. Thomson, Montreal, on "The Fuel Problem in Canada"; J. L. Landt, Buffalo, on "Fuel Preparation and Treatment," and John Blizard, New York, on "Principles of Combustion and Heat Transfer as Applied to Steam Generation." Active discussion, particularly on Professor Christie's and Mr. Thomson's papers, was participated in by the four hundred engineers in attendance.

Dr. Arthur Surveyer, retiring president, admitting that construction work in Canada has not yet approached the pre-war volume and may not do so for some time, said there was, none the less, a rapidly growing need in the Dominion for administrative and technical ability in connection with manufacturing industries and in the field of public utilities and financial affairs and that engineers were qualified to do executive work of this kind. George A. Walkem of Vancouver, B. C., was elected as the new president.

Projects Before the Federal Power Commission

The Broad River Power Company of Columbia, S. C., has applied to the Federal Power Commission for a preliminary permit covering a project on the Saluda River in Lexington County, S. C. It is proposed to build a dam 120 ft. high, which will create a reservoir extending 17 miles up stream. The intention is to install equipment capable of generating 50,000 kw.

A proposed dam across the Cowlitz River near Morton, Wash., would not come within federal jurisdiction, the commission finds. A development at that point is proposed by the Cascade Electric Company of Seattle.

The town of Highlands, N. C., has applied to the commission for a license covering a dam, power house and transmission line on the Cullasagee River, where it is proposed to establish a 200-kw. unit.

The Penn Public Service Corporation of Johnstown, Pa., has applied for a license covering a 132,000-volt transmission line from the Clarion River Power Company's plant to the lines of the Keystone Power Company. A 200-ft. right-of-way through the Allegheny National Forest is asked.

The Cliff Gold Mining Company of Laramie, Wyo., has applied for a preliminary permit covering a small development on the Middle Fork of the Little Laramie River in Albany County, Wyo. It is proposed to build a masonry dam 4,000 ft. long, at which 250 hp. would be developed for mining purposes.

Southern Rural Electrification Conference to Be Held

A joint call has been issued by the National Committee on the Relation of Electricity to Agriculture, the Alabama Farm Bureau Federation and the extension service department of the Alabama Polytechnic Institute for a conference on rural electrification in the South. This conference will meet in Montgomery on April 6 and 7 and in Birmingham on April 8. The excellent progress made in rural extension by Alabama led to the selection of that state as the one in which to hold the conference.

Dr. E. A. White of Chicago, director of the national committee, will preside and review the work that has been done in Alabama. Addresses and discussions on all phases of rural electrification will be made, and the speakers will include members of the faculties of agricultural colleges, representatives of power companies and men prominent in national affairs. Delegates are to be invited from extension service departments of agricultural colleges, county farm demonstration agents, officials of farm organizations and power producers. A feature of the program will be an inspection of completely electrified farms, dairies and poultry farms.

Ferguson Opposes Merger

President of Hartford Electric Light Criticises Northern Connecticut Utility Consolidation

QUESTIONS of far-reaching importance are involved in a petition recently heard by the Connecticut Public Utilities Commission seeking authority to merge the Connecticut River Company, Northern Connecticut Light & Power Company, Thompsonville Water Company, Stafford Springs Aqueduct Company and the Somers Electric Company into the Northern Connecticut Power Company, on behalf of the J. G. White interests of New York. At the hearing L. F. Robinson, Hartford, and Lawrence Bennett, New York, counsel for the merging companies, announced that the new company seeks to secure economies in management and development by the consolidation. Walter P. Schwabe, president of the Northern Connecticut Light & Power Company and manager of the proposed merger group, informed the commission that the plans of the White interests include construction of a large hydro-electric plant at Windsor Locks, Conn., for the conversion of surplus mechanical water power now sold to mills into electrical energy for more efficient application. He stated that the ownership and management of these companies have been practically one for several years.

The plans for financing the merger were questioned at the hearing by Samuel Ferguson, president of the Hartford Electric Light Company, who is a stockholder in the Thompsonville Water Company. Mr. Ferguson called the attention of the commission to the following points, emphasizing their bearing upon the current tendency toward consolidation in the public utility field:

1. There are two classes of companies which this merger contemplates combining: First, the stable, sound distributing companies having good earning power as represented by the Northern Connecticut Light & Power Company and the Thompsonville Water Company, entered in this proposal at conservative values considerably below what the prices paid for their stocks would represent, and, second, the Connecticut River Company, which must be considered as distinctly speculative, since a present earning power of $60,000 is capitalized at $1,750,000.

2. If the speculative part of this venture is a sound business risk, it can be financed without having to lean on the earnings of the non-speculative companies. If, on the other hand, it is not sound, it should not be allowed to lean upon them.

3. The purchaser of these companies is the J. G. White Engineering Corporation, which company is directly interested in doing the construction work of the contemplated hydro development and, therefore, may supposedly be expected to advocate this construction even if to others it might not seem so clearly to justify the cost.

4. In the case of this speculative development, this merger would in effect compel each user of water, gas and electricity to join in the speculation, since in case it did not prove profitable, the company's earnings must needs be made up from the rates to be charged. If successful, they would, of course, benefit; but why force this speculation on all customers?

5. The proposed valuation of the two utilities is approximately the book value of their fixed capital assets, and there could be no possible objection to their merging together on this basis; but the third company is an obvious catch-all, the valuation of which has of necessity been so appraised as to include the amount above book value which was paid for the companies, as well as to include prospective profits to the purchaser to be received in the form of preferred and common stock.

6. The prices paid for the stocks of the constituent companies which it is proposed to merge amounted to approximately $2,700,000. In the financial set-up proposed for the consolidated company there will be outstanding bonds nearly equal to this sum of money, and in addition there will be 10,000 shares of preferred stock carrying six-dollar dividends as well as 25,000 shares of no-par common stock.

7. This type of refinancing—namely, sale of bonds to reimburse the purchasers for the approximate cost of property and the retention of all the equities by the purchaser after he has been reimbursed—has lately become the subject of much criticism.

8. From the above it would appear that the commission has to decide a very serious question, namely, whether this merger as of this time is or is not against public interest, and whether public interest does not demand that the question be left until such time as the speculative part of this venture has been financed upon its own possibilities and has demonstrated by its operating results whether or not it can be combined in the public interest with the now existing public utility companies.

9. It is very questionable whether the users of gas, water and electricity should be compelled to back up a venture which requires at the start, not only the $1,750,000 capitalization, but also about $400,000 in the set-up in addition, and offers the major future advantages to those who are not customers.

10. The degree of speculation which may possibly be involved is indicated by the attached photos of the Connecticut River taken at that season of the year which is seldom emphasized in the prospectus of a hydro development.

Inasmuch as I am vitally interested in other public utility companies, I feel possibly more strongly than some that, in general, a halt must be called upon the growing tendency to use mergers and consolidations of properties which would otherwise seem to be desirable as a vehicle of abuse, and that unless each merger is carefully analyzed before approval is granted, there is liable to be such a fire of public disapproval started as will burn us all.

The commission took the case under advisement.

Union Electric of St. Louis to Spend $11,000,000

The Union Electric Light & Power Company of St. Louis will spend more than $11,000,000 in construction work to keep pace with the growing demand for electric power in its territory, President Louis H. Egan said in an address before the St. Louis Electrical Board of Trade at the Hotel Statler on Feb. 9. This money will be expended on additions to the Cahokia and Ashley power plants, for substations and line extensions.

"Obviously, the company furnishing the power on which its community depends very largely for its expansion and growth must keep pace with the demand," President Egan said. "In St. Louis, particularly, this demand is certain to continue growing because of the great industrial development going on and the certainty that it will continue. It is because of the certainty of growth in this district that recently, with the help of the North American Company, we bought the Keokuk Dam. It is because of this also that almost three thousand investors recently bought $4,000,000 of the company's recent stock issue in nine days."

The Union Electric Light & Power Company has adopted the pulverized-fuel system for firing the boilers at its Ashley Street plant in St. Louis. This plan has been used successfully at the big Cahokia plant of the company on the east bank of the Mississippi. Eight boilers at Ashley have already been equipped for powdered coal, and the remaining twelve lower-deck boilers will be so equipped in the near future.

Purchases and Mergers

Insull Indiana Companies Unite—North American Adds Properties—Other Transfers in All Sections

MERGER of the Northern Indiana Gas & Electric Company into the Northern Indiana Public Service Company, until recently called the Calumet Gas & Electric Company, is proposed in a petition filed with the Indiana Public Service Commission at Indianapolis last week. The operating revenue of the two companies last year aggregated in excess of $10,000,000. Their combined capitalization is $44,928,000. Both are Insull properties operating in the same general territory in northern Indiana. The number of communities served by the Northern Indiana Public Service Company after the merger will be 119. Twenty-five counties with a population of 560,000 will be served. The Northern Indiana Public Service Company owns the 132,000-volt line extending from the Illinois-Indiana state line to Michigan City, Ind., and an extension is being built between Michigan City and South Bend which will form an interconnection with a similar system extending as far east as Pittsburgh, Cleveland, Toledo and points in Virginia, West Virginia and Kentucky. The company's line is interconnected with similar systems of the Commonwealth Edison Company in Chicago and the Public Service Company of Northern Illinois. The Northern Indiana Gas & Electric Company operates a generating station at East Chicago with a capacity of 28,000 kw. After the properties are consolidated, the company will have 121,500 kw. available. Some of the larger cities served by the two companies to be merged are Hammond, East Chicago, Whiting, South Bend, Mishawaka, Elkhart, Fort Wayne, Michigan City, Lafayette, Logansport, Valparaiso, Plymouth, Crawfordsville, Frankfort, Wabash and Peru.

The Northern Indiana Public Service Company, has been authorized by the Indiana Public Service Commission to purchase the L. D. Holley Electric Company of South Milford, Ind., for $13,000.

The North American Company announced this week the acquisition of the Iron Mountain Light & Power Company of Iron Mountain, Mich., and the Niagara Light & Power Company of Niagara, Wis. The properties are valued at $500,000. The Peninsular Power Company, another recent acquisition of the North American Company, will supply power to the two companies, which will be operated as part of the North American systems in Wisconsin and Michigan.

The Hayward (Wis.) Electric Light & Power Company, with a small hydro-electric plant on the Namakagon River, has been taken over by the Lake Superior District Power Company.

A large addition has been made to the generating facilities of the Northern States Power Company in western Wisconsin by the purchase of the Chippewa Power Company's Jim Falls hydro-electric plant on the Chippewa River, all of the output of which had been sold under lease to the Northern States Power. This plant, which generates 16,085 hp. during satisfactory

water periods, was built in 1922-1923.

The New Jersey Gas & Electric Company, serving suburban territory in Dover, N. J., has been added to the Fitkin utility interests.

Announcement that the Eastern New York Utilities Corporation is to be absorbed in the system of the Northeastern Power Corporation, the organization formed to bring together electrical properties from northern New York to New England, was made last week. This will be brought about through merger of the Eastern New York corporation with the Mohawk & Hudson Power Company, one of the companies in the Northeastern group.

Sale of the municipal lighting plant at Louisville, Ga., to the Georgia Southern Power Company has been effected. The plant was built twenty-five years ago, being one of the first municipally owned electric light plants in the state. Transmission lines will be built to connect Louisville with company's system.

Besides the purchase of the privately owned central station at Brighton, Col., noted last week, the Public Service Company of Colorado has recently acquired the Suburban Light & Power Company at Aurora, Col. It is understood that negotiations are being carried on with a number of other independent plants.

There has been no merger of the Counties Gas & Electric Company of Norristown, Pa., and the Philadelphia Suburban Gas & Electric Company, as reported in the daily press. Both these companies are controlled by the United Gas Improvement Company of Philadelphia, and their facilities have merely been combined under one management.

Connecticut Valley Tie-in Saves $300,000 in Ten Months

The transmission line built by the Connecticut Power Company to connect the Hartford Electric Light Company with the systems of the United Electric Light Company, Springfield, Mass., and the Turners Falls Power & Electric Company has exceeded expectations in resultant economies in plant operation. The savings effected by the most economical operation of the three systems without regard to ownership and the consequent maximum use of surplus water have resulted in a total fuel saving of about $300,000 in the past ten months. In addition, through the pooling of spare facilities, the three companies have obtained the equivalent of an additional station capacity of about 30,000 kw.

Rural Extensions of Ontario Hydro System

The Ontario government has just issued a report which shows that the development of rural service by the Hydro-Electric Power Commission in the last fiscal year cost the province, under its guarantee of 50 per cent payment of primary and secondary costs of transmission, a round sum of $335,000, which, in effect, represents the most active twelve months in the history of rural power extensions. All sections of Ontario shared to some extent in this government aid. Existing government requirements call for three services per mile of rural construction, and consequently sparsely settled sections cannot begin to show evidence as yet of the high state of development that is common, for instance, in the southwestern peninsula.

According to Hydro officials, last year's capital cost of rural construction represents also between 400 and 500 additional miles of service. To the average farm consumer the monthly cost of power, figured on the usual farm contract basis, was between $6 and $9.

Chicago's New Traffic Signals Go Into Operation

Forty-nine street intersections within the "Loop" district in Chicago have been equipped with three-light traffic signals on each corner, and these went into service Feb. 7. They are all served from underground circuits terminating at the City Hall, where a central control board is situated. This board, which was built under the specifications of the Department of Gas and Electricity, provides very flexible control. For example, the interval between traffic halts at intersections along the same street may be changed, or the ratio between periods on intersecting streets may be varied.

Outside the "Loop" 87 intersections, some involving three streets, are being rapidly equipped with traffic signals on each corner. These signals are controlled by local panels which also permit flexible combinations of operation.

Energy for the units outside the "Loop" will be furnished by the Commonwealth Edison Company. According to reports based on tests, each unit equipped with six 50-watt lamps will consume about 3,800 kw.-hr. a year, based on 24-hour operation, or about 1,320,000 kw.-hr. a year, figured on 87 intersections of four units each. It is expected to operate the signals inside the "Loop" from 7.30 a.m. to 12.30 midnight, making the consumption per unit per year about 2,650 kw.-hr. With 49 intersections having four units each, the consumption on the schedule mentioned would be 530,000 kw.-hr. a year.

Joint Action in Illinois on Overhead-Line Rules

The proposed General Order No. 115 of the Illinois Commerce Commission, relating to overhead construction, was the subject of a public hearing before that body at Chicago Feb. 9. Objections were submitted by railroad, communication and power utilities, those of the latter, which were summarized last week, being chiefly that the proposed order invades the rights of management and requires construction the expense of which is not compensated by the public benefit. As a result of the hearing the commission and the several utility interests agreed to the formation of a joint committee which will try to work out a satisfactory arrangement, and in view of this agreement the companies did not file the formal brief they had prepared. This committee will consist of sixteen members and it will have three months in which to submit a new set of rules.

Merrill on Boulder Dam Bill

Federal Commission Secretary Shows Its Defects—Outlines Possible Financing Plan

RESPONDING to a request from Senator McNary, chairman of the Upper House's committee on irrigation and reclamation, for his comments on the Swing-Johnson bill for the governmental financing of a power and irrigation dam at Boulder Canyon on the Colorado River, O. C. Merrill, executive secretary of the Federal Power Commission, has written a long letter in which he criticises the plan in detail, dwelling especially on the absence of certain public safeguards, to the number of eleven, expressly set forth in the water-power act and not made applicable in the bill.

Although personally opposed to the whole scheme for federal construction of this dam, Mr. Merrill has drawn up and included in his letter to Senator McNary "Proposals for Handling Colorado River Power Project if Financed by the United States." These proposals provide for a special issue of 50-year United States bonds, not tax-exempt, to be sold as required to meet costs of construction, which would not be undertaken until contracts had been executed with power lessees and irrigation districts. The power lessees would come under the provisions of the federal water-power act, receiving first a preliminary one-year permit and then a fifty-year license. Construction work would be done by the Reclamation Service and the project turned over to the licensee on completion of construction. The licensee would assume costs of operation and maintenance, the districts benefited paying their respective shares of the cost of flood control.

Provisions follow for the payment of 6 per cent interest and the gradual retirement of the bonds by the licensee and the irrigation districts, failure to live up to these conditions to be followed by the forfeiture of rights. With the final retirement of the bonds the project would become the property of the licensee under the provisions of the water-power act. In case of any dispute or disagreement between the licensee and any purchaser or prospective purchaser of power therefrom for distribution and sale to consumers respecting the allocation of power to such purchasers, and in case of any dispute or disagreement respecting the allocation of power to any state or group of states or to any municipality or group of municipalities, whether such power were transmitted and sold to consumers by the licensee or by a purchaser of power therefrom, the allocation of such power would, unless the matter came within the jurisdiction of the public service commission of the state within which such power was delivered or sought to be delivered, be heard and determined by the Federal Power Commission upon application by any party in interest, and any such determination would be binding upon the licensee and upon such purchaser, provided that neither the licensee nor such purchaser would be required to make delivery of power in any specified territory except upon a finding by the commission that the revenues to be re-

ceived appeared sufficient to afford to the licensee or to the purchaser a reasonable reimbursement of the cost of delivery, including a reasonable return upon the investment in plant or properties used and useful in effecting such delivery.

Governor Hunt on Warpath

Arizona's Executive Denounces Colorado Project, California, Hoover and Others

A LETTER sent to Senator Ashurst of Arizona by Governor W. P. Hunt of the same state reiterates in determined language the Governor's opposition to plans for the development of the Colorado River favored in California and not opposed by the other Colorado Basin states. The letter says:

"Los Angeles and California, with their wealth and arrogance, their newspapers, propaganda agencies, their distinguished Representatives and Senators, Commissioner of Reclamation Mead, the powerful influence of the Californian Hoover in the Cabinet and the co-operation of Secretary Work of the Department of the Interior, may succeed in inducing the United States and the other states in the basin to join in the rapine of Arizona. But it will never have Arizona's legal consent, and if I am in position to have anything to say in the matter it will be over Arizona's physical protest."

Governor Hunt says he was impressed by the testimony offered on behalf of the upper Colorado Basin states, especially as to "their desire and intention to utilize every means at their command to conserve and protect their rights to use the water that falls within their borders." He declared that Arizona has no irrigation or power possibilities outside the Colorado River and its tributary, and that a small part of California with about 2½ per cent of the drainage area wants 37 per cent of the water and control of a majority of the power. The Governor further declared:

"The most interesting factor of the California position is the endeavor to use the United States government to despoil Arizona and to use United States government money to build a power dam located in two other states, the government to be repaid from power generated by these two other states, and California lands to be furnished with a canal, flood control and municipal water at the expense of these two other states."

Discussing the Santa Fe compact and the willingness of Arizona to give protection to the upper states, Governor Hunt wrote:

"But in order to get protection for themselves, some of them appear willing to barter with California through a six-state compact to enable that state to have the federal government construct a dam so low on the river as to absolutely condemn large areas of Arizona to remain a desert, give California all the water she can use and permit the remainder of the water to cultivate lands in Mexico owned by other California citizens. The real gall of the proposal is that Arizona and Nevada power is to pay for the cost of giving all this to California."

Revised Colorado Bill Is Indorsed by Secretary Work

After suggesting several amendments in line with his recommendations on the original bill, Secretary Work of the Interior Department has informed the House committee on irrigation and reclamation that the revised bill for the protection and development of the lower Colorado River constitutes, in his opinion, a feasible and workable measure. This bill was drawn up in an effort to meet the proposals of Secretary Work for changes in the Swing-Johnson bill for the construction of the Boulder Canyon Dam through a federal bond issue, the ends sought including protection of the rights of the upper states and central control by the government of the power, water and other privileges. All of the recommendations proposed by the Secretary in his first report, however, were not accepted by the committee, and he takes the opportunity to reiterate those not incorporated in the measure as it stands.

The most important amendment proposed to the revised bill is in connection with the all-American canal. The Secretary suggests that the bill be changed to leave optional the construction of this canal in the event that Mexico shall be found unwilling to modify the terms of a concession made by that country to an American corporation relating to the transportation of water through the present Imperial Valley canal. An amendment is also suggested to omit the granting of preference rights to electrical energy developed at the dam to certain organizations. The report recommends that the allocation, sale and delivery of this energy be left to the discretion of the Secretary of the Interior after opportunity has been had for exhaustive consideration of the public interest and the equities and needs of the applicants. As to a proviso in the revised bill which suggests two alternatives to the method originally proposed for generating and disposing of electrical energy—namely, the alternatives of leasing of generator units or the leasing of water for the development of power—the Secretary states that inasmuch as these alternatives are left wholly to later determination, thus permitting further study, it is deemed unnecessary at this time to discuss their relative merits.

Resolutions urging the Legislature of Arizona to make appropriations for construction of a Colorado River dam by the state were adopted by Arizona Democrats at a meeting held in Phoenix on Feb. 8. The politicians, gathered to effect a permanent organization, predicted that the Colorado River question, with opposition to nationalization of the stream, would be the principal campaign issue in Arizona this year. Resolutions commending Senator Ashurst and Representative Hayden for their stand in opposition to the Swing-Johnson bill were adopted.

Edison Monument Illumined

Through the action of the Public Service Corporation of New Jersey, the monument erected at Menlo Park by the Edison Pioneers' Association on the site of the original laboratory of Thomas A. Edison will hereafter be floodlighted at night so as to be visible from the trains of the Pennsylvania Railroad as well as from the Lincoln Highway. This illumination was inaugurated on Edison's seventy-ninth birthday (Feb. 11). The monument consists of a boulder about 6 ft. high mounted on a concrete base 12 ft. square arranged in two steps. The illumination is provided by two 300-watt lamps. This recognition of Mr. Edison's services to the electric light and power industry was made with the co-operation of the Edison Pioneers' Association through its president, Charles L. Edgar.

Briefer News

Nortonville, Ky., to Have Generating Station.—The Kentucky Electric Power Corporation of Nortonville, Ky., has engaged the J. G. White Engineering Corporation of New York to design and construct a steam-electric power station of 5,000 kw. rating at Nortonville. The plant will use pulverized fuel and have high-pressure boilers and turbines and will be designed for future extension.

Santiago, Chile, to Lead South America in Street Lighting.—Santiago, the capital of Chile, is changing an outgrown street-lighting system for a modern one which, it is said, will make it the best-lighted city in South America. More than 8,000 lighting units will be required, and the system will represent an investment of several million dollars. None of the lamps will be rated at less than 4,000 lumens, and the maximum will be of 15,000 lumens rating. The International General Electric Company is supplying the lighting units, the transformers and the control equipment.

Russia's New Generating Station.—The opening of the largest electrical power station ever constructed in Russia is announced in recent bulletins to the Russian Information Bureau. The station is at Shatura, near Moscow. Its total capacity will be 83,000 kw., and it now furnishes 32,000 kw. The second largest station is the Volkovstroy plant, near Leningrad, which has a projected capacity of 58,000 kw. The Shatura plant was begun in the summer of 1923. It is one of a series of thirty regional stations planned for completion in the next few years as a first step toward the electrification of the Soviet Union. Eight of the thirty stations are now in full or partial

operation. The Shatura station operates on local peat, of which there is a supply of 65,500,000 metric tons, enough to last for 100 years in a station twice the capacity.

Second Unit at Des Moines Nearly Ready.—The second 30,000-kw. turbo-generator being installed at the new Ball's Ford power house of the Iowa Power & Light Company near Des Moines is almost ready for operation, according to M. G. Linn, vice-president and general manager. Only the wiring remains to be completed, after which the new turbine will be put into service. The first unit went into operation in the fall of last year.

Illinois Power & Light to Double Its Venice Plant.—The Illinois Power & Light Corporation of Chicago has purchased a large plot adjacent to its present power plant at Venice, Ill., and contemplates improvements to cost approximately $5,000,000. The capacity of the plant will be doubled by the addition of a 30,000-kw. turbo-generator, and three 1,500-hp. boilers will also be installed. River intakes are nearing completion. The plant will serve the lines of the company between Peoria and Cairo, Ill.

Chippewa Falls Disputes Value Put on Local Plant by Northern States Power Company.—Electric light companies and municipalities in Wisconsin have watched with marked interest the proceedings before the Railroad Commission to ascertain the value of the electric plant at Chippewa Falls, which the citizens voted to acquire from the Northern States Power Company. All efforts to reach an agreement on the sale price have failed thus far. The chief point of difference is the reproduction value of the plant. The company's price is $200,000, or $20,000 more than the city cares to pay.

Vermont Electrical Association Meets Next Week.—The winter meeting of the Vermont Electrical Association will be held in Brattleboro, Vt., on Feb. 25, at 3 p. m., at the rooms of the Brattleboro Business Men's Club, where, after a short business meeting, W. T. Ackerman of the University of New Hampshire will speak on "Rural Service Projects." A banquet will be served at the Brooks House, after which H. T. Spaulding, National Electric Lamp Laboratories, will speak on the "New General Line of Lamps." There will be other speakers with a general discussion. Rooms have been provided for manufacturers' exhibits.

Mercury Boiler for South Meadow Station?—A significant reference to the possible use of the mercury boiler on a larger scale was made by President Samuel Ferguson of the Hartford Electric Light Company in his annual report for 1925 to stockholders, as follows: "During the year the General Electric Company has redesigned the mercury boiler to incorporate such improvements as our former tests showed to be practicable and desirable, including the building of the turbine as a three-stage machine. The redesigned equipment has been in operation at your Dutch Point plant, and we trust that as a result of its operation the General Electric Company may be in a position to accept an order for a larger installation at the South Meadow station."

Engineering Foundation Elects Officers.—At the annual meeting of the Engineering Foundation last week, the following officers were elected for the ensuing year: Chairman, Lewis B. Stillwell; vice-chairmen, Elmer A. Sperry and George A. Orrok; additional members of executive committee, J. Vipond Davies and Arthur M. Greene, Jr.; director and secretary, Alfred D. Flinn; treasurer, Jacob S. Langthorn; assistant treasurer, Henry A. Lardner.

Oswego, N. Y., to Vote on Power Issue.—The Water Service Commission of Oswego, N. Y., is about to seek bids from utility corporations and manufacturing companies that may be interested in leasing and developing the water power owned by the city at Dam No. 6 in the Oswego River. The bid most advantageous in the opinion of the Common Council will be submitted to a public vote at a special election which it is expected to hold in time to permit obtaining any legislation that may be found necessary from the Legislature now in session.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see Electrical World, Jan. 2, page 80.]

Vermont Electrical Association—Brattleboro, Feb. 25. A. W. Peterson, St. Albans, Vt.

Oklahoma Utilities Association—Mayo Hotel, Tulsa, March 9-11. E. F. McKay, Local Bldg., Oklahoma City.

Illinois State Electric Association—St. Nicholas Hotel, Springfield, March 17-18. R. V. Prather, 205 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Electrical Inspectors' Association—Madison, March 17-18. A C. Schultz, Underwriters' Exchange Bldg., Milwaukee.

American Institute of Electrical Engineers—Regional meetings: Cleveland, March 18-19; Madison, Wis., May 6-7, and Niagara Falls, N. Y., May 26-28. F. L. Hutchinson, 33 West 39th St., New York.

Middle West Division (and Iowa Section), N. E. L. A.—Fort Des Moines Hotel, Des Moines, April 8-10. H. M. Davis, Fraternity Bldg., Lincoln, Neb.

Southwestern Public Service Association—Galveston, Tex., April 13-16. E. N. Willis, 403 Slaughter Bldg., Dallas.

Southwestern Division, N. E. L. A.—Galveston, Tex., April 13-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio.

Southeastern Division, N. E. L. A.—Pinehurst, N. C., April 27-29. C. M. Killian, Hurt Bldg., Atlanta.

Nebraska Section, N. E. L. A.—Lincoln, April 29-30. H. M. Davis, Fraternity Bldg., Lincoln.

Missouri Association of Public Utilities—Springfield, Mo., May 2-4. F. D. Beardslee, 315 North 12th St., St. Louis.

Electrical Manufacturers' Club—Hot Springs, Va., May 12-15. W. F. Field, Safety Cable Co., New York.

National Electric Light Association—Atlantic City, N. J., May 17-21. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club—The Homestead, Hot Springs, Va., May 24-27. S. N. Clarkson, Keith Bldg., Cleveland.

Walla Walla, Wash., Flirting with Municipal Ownership.—The City Commission of Walla Walla, Wash., has passed a resolution calling on the Walla Walla Rate Commission, a joint city and Chamber of Commerce committee of business men, who instigated and directed the recent movement to secure a reduction in electric rates, to investigate and report with regard to the establishment of a municipal lighting plant and system of distribution.

Byllesby Firm Will Build Government Dam at Falls of Ohio.—The Byllesby Engineering & Management Corporation, Chicago, which controls the Louisville Gas & Electric Company and the Louisville Hydro-Electric Company, was found to be the low bidder when bids were opened at Cincinnati last week for construction of Navigation Dam No. 41 at Louisville, to replace the present dam, built a quarter of a century ago and now obsolete. The Byllesby bid was $2,056,187. The Byllesby interests some time ago, through the Louisville Hydro-Electric Company, obtained the water rights of the Ohio Falls at Louisville, where a power plant to cost about $6,000,000 will be installed as a separate and private enterprise, license having been granted by the Federal Power Commission. The government navigation dam will also impound water for use of the power plant and the Byllesby engineers are therefore the logical builders. The new dam is to be completed by Dec. 31, 1928. Its crest will be 8 ft. higher than that of the one which it will replace, and a fall of 37 ft. will be insured.

New York City's "Great White Way."—Flashing 25,000,000 cp. of light against the sky each night, New York City's "Great White Way" may truthfully be called "the brightest spot on earth." The figure is contained in an electric sign survey made public by Arthur Williams, vice-president for commercial relations, New York Edison Company, in connection with the opening of the company's fourth annual electric sign show on Monday, Feb. 15. Contrary to popular impression, however, the "Great White Way" is not primarily a creation of the theaters. The Edison company's survey shows that of the 17,000 electric signs on Manhattan Island below 135th Street more than 2,800 are restaurant signs, more than 1,300 are barber shop signs, more than 1,100 advertise tobacco, 867 are clothing advertisements, 763 advertise automobiles and their accessories. Theaters take seventh place with 706 electric signs. Mr. William's report of the survey shows that approximately 5,000 electric signs were added to New York's night skyline during the last year. Sixty-five manufacturers, representing every section of the country and every branch of the electric sign industry, participated in the show.

Men of the Industry

Hartford Directorate Enlarged

V. E. Bird, vice-president Connecticut Power Company, New London, Conn.; G. W. Lawrence, president, and W. Rodman Peabody, general counsel Turners Falls (Mass.) Power & Electric Company, have been elected directors of the Hartford Electric Light Company. R. W. Day, president United Electric Light Company, Springfield, Mass., will be invited to join the board.

Harry Kilbourne has been appointed superintendent of the Galeton North Penn Power Company, Galeton, Pa., succeeding E. D. Menkee, resigned.

Omer F. Lewis, vice-chairman of the Hydro-Electric Commission of Sarnia, Ontario, has been elected chairman for 1926, in succession to J. R. Henderson.

Henry Benson has been named superintendent of the Lake Superior District Power Company's electric properties at Mellen, Wis.

W. H. Carter, president of Carter-Halls-Aldinger Company, Winnipeg, has been elected to the board of directors of the Winnipeg Electric Company.

Thomas Gray of the maintenance department of the Public Service Company of Colorado has been appointed manager of the newly acquired plant in Brighton, Col.

F. S. Whitely has been made manager of the Wisconsin Power & Light Company's properties at Fond du Lac to fill the vacancy caused by the promotion of M. H. Frank to be general manager.

H. J. Austin, superintendent of the Tuscola (Ill.) branch of the Illinois Public Service Company, has been advanced to the Mattoon office, and **F. W. Allison** of Nokomis has been named to succeed him.

Floyd L. Vanderpool and **James N. Miller** were elected directors of the Trumbull-Vanderpoel Electric Manufacturing Company, Bantam, Conn., at the stockholders' meeting, Feb. 3. The directors elected John H. Lancaster chairman of the board, a newly created office. Officers were re-elected.

George E. Balch, for nearly four years superintendent of construction for the Northern States Power Company in Sioux Falls, S. D., has been transferred to the Green Bay (Wis.) plant in the line of promotion. Transmission lines extending from the Sioux Falls plant to adjacent territory in southwestern Minnesota and to numerous South Dakota points were built under his direction. Prior to going to Sioux Falls he was with the same company at Minot, N. D.

L. C. Brooks, for the past eight years electrical engineer of the Bethlehem Shipbuilding Corporation, has resigned. He expects to take a much-needed vacation and after that will probably undertake a business venture along entirely different lines. He has been identified with the marine industry since the days of the first electric ships—the *Kearsarge* and *Kentucky*—which were built at Newport News and delivered in 1900. He has been a member of the A.I.E.E. committee on marine applications for eight years, serving as secretary for five years and as chairman two years.

Harry E. Hayworth of Crawfordsville, Ind., has been appointed as superintendent of the Frankfort (Ind.) municipal light and power plant. Mr. Hayworth, who succeeds Charles Elkler, was previously in charge of the Crawfordsville plant for several years.

Ralph Rainsford Joins Executive Staff of Condit Company

Ralph Rainsford, formerly chief engineer of the Philadelphia Company, Pittsburgh, has joined the Condit Electrical Manufacturing Corporation, Boston, now a subsidiary of the American Brown Boveri Company, as a consulting engineer on the executive staff. Mr. Rainsford has been associated with engineering developments in the Pittsburgh area since 1922. Previously he had a wide executive and engineering experience, during which and since he acquired many friends.

RALPH RAINSFORD

Col. R. E. B. Crompton, C. B., twice president of the Institution of Electrical Engineers in Great Britain, has been made by the council of that association the fifth recipient of the Faraday medal. Colonel Crompton is among the British pioneers in electrical engineering.

William Burbage of Carthage, Tenn., has been made manager of that division of the Tennessee Electric Power Company, formerly the Smith County Electric Company. Mr. Burbage has been engaged in the electric light and power business for fifteen years.

Harry W. Brown, for the past four years attached to the central-station supplies office of the Boston office of the General Electric Company, has resigned after 30 years' service with this company. Soon after completing his course at the Massachusetts Institute of Technology Mr. Brown was connected with the meter sales department in New York and later with the lamp and meter sales division at the Boston office of the General Electric Company.

F. M. Black, vice-president in charge of finances of the Winnipeg (Manitoba) Electric Company, has resigned to go into business for himself. It is understood that the office will not be filled again by the company. Following his resignation as Provincial Treasurer in the Manitoba government, Mr. Black commenced his duties with the company in January, 1925. The business to which he will devote his attention in future will be financial in character.

Ollison Craig has been appointed consulting engineer of the Riley Stoker Corporation. Mr. Craig was graduated from the University of Illinois in 1909. For the next seven years he was engaged in educational work in the mechanical engineering departments of the University of Colorado, Vanderbilt University and Iowa State College. Following this he was with the Charles L. Pillsbury Company, consulting engineers at Minneapolis, going thence to the Underfeed Stoker Company of America as research engineer. He continued in this position after the consolidation of that company with the Riley Stoker Corporation until the appointment just made.

Obituary

Paul B. Trammell, chairman of the Georgia Public Service Commission, died at his home in Dalton, Ga., on Feb. 10. Mr. Trammell had been a member of the commission for the past fifteen years.

Thomas L. Ward, vice-president of the Citizens' Heat, Light & Power Company of Winchester, Ind., died recently in that place, following an operation for appendicitis. He retired from business about two years ago. Mr. Ward was 55 years old.

Charles A. Boody, a member of the executive committee of the Brooklyn Edison Company, director in other utility companies in Greater New York and president of the People's Trust Company of Brooklyn, died last week at the Brooklyn Hospital after a protracted illness.

Jesse H. Purdy, senior vice-president of the American Water Works & Electric Company, died in Pittsburgh Feb. 16 after an illness of several weeks. Mr. Purdy had been with the company for 50 years and during that period had directed the construction of many of its water plants. He was 77 years of age.

W. J. Santmyer, connected with the Puget Sound Power & Light Company of Seattle, Wash., for many years, died in Rochester, Minn., on Jan. 24, after a short illness. Mr. Santmyer became associated with the power company, then known as the Seattle Electric Company, in 1899 and served it in various capacities. At his death he was division superintendent in charge of the steam department. Mr. Santmyer was born in West Virginia and was 69 years old.

Recent Court Decisions

Fire Originating in Inflammable Material Actionable, Though Concurring Cause Was Lightning.—In Lawrence vs. Yadkin River Power Company damages were awarded for the destruction of trees and vegetation on plaintiff's land when the defendant's transmission line on right-of-way was struck by lightning. The North Carolina Supreme Court has sustained the award, affirming that it is actionable negligence for an electric light and power company to permit inflammable grass and vegetable matter to accumulate on a right-of-way maintained for a power transmission line, even though the fire leading to the damage suit actually resulted from lightning striking the line and causing insulating material to melt and fall in a molten mass into the inflammable substance. Such injury, the court held, cannot be construed as solely an act of God. (130 S. E. 735.)*

Utility Must Pay Fair Cash Value of Right-of-Way and Not Merely Value of Easement.—The Supreme Court of Tennessee has held, in Kentucky-Tennessee Light & Power Company vs. O. R. Beard, a suit in which both parties appealed from the verdict of a jury fixing damages for a right-of-way acquired for a high-tension transmission line, that the defendant was entitled to recover the fair cash value of the land appropriated and not the mere value of the easement acquired. The court said: "We think petitioner having acquired a permanent easement in the strip of land mentioned and described in its petition and in the consent decree entered in the case, it became liable for the value of that strip as if the fee had been taken. The right of petitioner to use this strip for all the purposes of its business, and to control it and limit the right of the defendant in its use, is fixed by law. Defendant must obtain his compensation now for the property taken from him, and if he fails to obtain adequate compensation in this proceeding, he will be without remedy hereafter. The power company has the unquestioned right to occupy the whole of said strip of land at any time the exigencies of its business may demand such occupancy. It has the right to exclude the owner from the strip when necessary; it has a right always to enter upon the strip for the purpose of improving, repairing and building additions to its line or lines, and if necessary, destroy any crops that may be growing thereon. Any right the owner has to use the premises is subordinate to the prior and superior rights of the power company. The owner has lost his right to build houses, fences and other structures upon said land; he has lost his right to grow timber upon it; his interest in the property has been reduced to that of a servient estate subject to the rights of petitioner, and petitioner may exclude him absolutely from said premises at any time the exigencies of its business may require. . . . We think, in view of the fact that petitioner has acquired a permanent easement in the land appropriated, and that such uses which defendant may and is making of the land burdened by said easement are merely permissive and subject to the paramount right of revocation by petitioner, they cannot be availed of in reduction of the defendant's compensation. Petitioner has the right at any time the exigencies of its business may require to plan other poles and locate other lines and structures along and on its right-of-way or easement acquired in said strip of land, and to exclude the defendant therefrom entirely."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Ohio Commission Right in Allowing Utility to File Schedule for Period When No Rate-Fixing Ordinance with City Was Existent.—The Public Utilities Commission of Ohio found that there was no rate-fixing ordinance in effect in the city of Cincinnati for the period between May 1 and May 19, 1925, and decided that the Union Gas & Electric Company had the right to file with it a schedule of rates covering that period. A court order denying the motion of the city in an action against the company to have the schedule stricken from the files has been sustained by the Supreme Court of Ohio, which held that the commission acted rightly. (150 N. E. 48.)

Failure to Use Disconnecting Stick on Faulty Transformer Not Contributory Negligence.—In Smith vs. Tri-County Light & Power Company, an action for damages based on the destruction of a barn alleged to have caught fire because a transformer was defective and allowed heavy voltage to enter the building, the jury returned a general verdict for the plaintiff, but the trial judge sustained a motion for judgment for the defendant based on certain special findings by the jury. The Supreme Court of Kansas has found that these special findings did not conflict with the general verdict and has therefore reversed the judgment. Contributory negligence was claimed because the plaintiff did not use a long stick supplied to him to pull out the plug from the transformer in case of trouble, but the Supreme Court held that he was justified in fearing to do so. (241 Pac. 1092.)

Binding Contract by Public Utility May Be Enforced Unless Relieved by State in Interest of Public.—In a judgment relating to baggage regulations on railroads (State Railroad Commissioners vs. Jacksonville Terminal Company), the Supreme Court of Florida declared that a binding contract by a public utility company may be enforced against the utility company unless relieved by the state in the interest of the public, but this must be a binding contract that is not forbidden by any provision of controlling law. "Orders, rules and regulations of the railroad commissioners," said the court, "are administrative in their nature, and though they are by statute made *prima facie* reasonable and just, yet to be enforced by the courts when violated they must be within the scope and intent of the authority conferred by statute, must be in accord with applicable organic provisions and limitations, and must be reasonable and just with reference to all rights materially affected thereby. Such orders, rules and regulations are not final adjudications, and they are subject to appropriate judicial review for the protection of organic or substantial rights." (106 So. 576.)

Commission Rulings

Company Cheated by Customer Need Not Serve Defrauder Until Restitution Is Made.—The California Railroad Commission refused to order the Mentone Water Company to restore service which had been discontinued until a consumer paid for water appropriated from the mains by means of secret connections. The commission said: "The standardized rules and regulations of the Railroad Commission governing the relations of public utility water companies with their consumers contain provisions permitting a utility to discontinue the service of water to any premises when such action is necessary in order to protect itself against fraud. While this particular rule was not specifically adopted and filed with the Railroad Commission as one of the official rules of this company, yet such adoption is not necessary in order that a utility may protect itself against persons committing fraudulent acts which are in themselves actionable at law. When one admitting the commission of such acts comes before the commission as a suitor seeking justice by demanding service from a utility which for years he has secretly defrauded, he certainly does not appear with 'clean hands.'"

Alleged Interference with Radio Reception Not in Itself Sufficient Reason to Compel Reconstruction.—Complaint was made to the Public Service Commission of Oregon that the plant and equipment of the Skamania Light & Power Company in Cascade Locks was not of standard construction and was so installed as to result in hazard to the public and to workmen. It was also charged that this faulty construction resulted in interference with radio reception in the community. The commission, finding that the plant and equipment was not constructed and maintained in accordance with approved practice or with the National Electrical Safety Code, ordered that all hazards to the public or to employees should be removed. On the question of radio interference it said: "While considerable testimony appears in the record as to the effect of this condition on radio reception, the question is one which is difficult to determine definitely, and in view of this fact we would be hesitant to issue an order of the nature prayed for based merely upon the possibility that a modification of the electrical construction might improve radio reception. It is probable that the proper reconstruction and maintenance of the electrical plant will result in some improvement."

Financial and Corporate

Utility Market Weakens

Setback in General List of Exchange Stocks Is Accompanied by Drop in Utilities

ALTHOUGH the new developments of the week under review were bullish, the market movement reflected bearish tendencies. Among the more constructive factors that may be named are the settlement of the coal strike, the increased activity in building, the inauguration of higher dividend rates for certain leading industrials and the record activity for this season of year in the motor industry. That stocks on the New York Stock Exchange should have turned distinctly weaker in the face of all this must be explained by the fact that pool operations in many cases had been effective in forcing issues up to levels at which favorable conditions had been more than discounted.

The smart shake-out in the industrial and railroad list was accompanied, naturally enough, by weakness in issues of the power and light group. United Gas Improvement fell ten points at one time on Monday, for example, and numerous stocks that had previously been market favorites dropped as selling pressure increased. On the Stock Exchange American Water Works & Electric Company's shares failed to withstand the pressure brought against them, but their decline was small relatively when compared to that of other listed stocks. On the New York curb market the Northern Ohio Power Company's stock, which for several weeks had been maintained at different levels above 20, dropped almost overnight to a position nearer 17 on heavy selling.

Among the losers were Arizona Power preferred, Commonwealth Power preferred and common shares, Eastern States Power, General Gas & Electric B stock, Northern Texas Electric preferred, American Gas & Electric, American Light & Traction, American Power & Light and Southeastern Power & Light Company's securities. Gains, on the other hand, were registered by such issues as Georgia Railway & Power and Tampa Electric common.

New Capital Issues

The Alabama Power Company made an offering of first mortgage lien and refunding gold bonds to the amount of $5,000,000, the price being 98 and interest, to yield over 5.14 per cent. Another sizable offering was the three-million-dollar issue of 6½ per cent sinking-fund collateral-trust gold bonds of the Western United Corporation, priced at 99½ and interest. Funds derived from the sale of these bonds will be used for the acquisition of the Western United Gas & Electric Company and for other corporate purposes.

First mortgage twenty-year sinking-fund 6 per cent gold bonds of the Arizona Edison Company totaling $2,000,000 were issued at 97½ and interest, to yield 6.22 per cent. The Electrical Securities Corporation also participated in the week's financing to the extent of $1,000,000 in the form of collateral-trust sinking-fund 5 per cent gold bonds priced at 96½ and accrued interest, to yield about 5.23 per cent.

Copeland Products, Inc., recently issued 60,000 shares of class A participating stock at $27 per share. Each share has attached thereto a subscription warrant expiring Feb. 1, 1928, entitling the holder to purchase from the company one-half share of class B stock, or voting trust certificates therefor, on the basis of $7.50 per share.

Dividends Declared

The quarterly dividends listed below have been recently announced:

Name of Company	Per Cent	When Payable
American Power & Light, com	.25	Mar. 1
Associated Gas & Elec., $6 pf	$1.50	Mar. 1
Associated Gas & Elec. $6.50 pf	$1.62½	Mar. 1
Central Arkansas Ry. & Lt., pf	1¾	Mar. 1
Detroit Edison	2	Apr. 20
Eastern Shore Gas & Elec., pf	2	Mar. 1
Fairbanks, Morse & Co., com	.75	Mar. 31
Fairbanks, Morse & Co., com	.75	June 30
Fairbanks, Morse & Co., com	.75	Sept. 30
Fairbanks, Morse & Co., com	.75	Dec. 31
Federal Light & Traction, com	.20	Apr. 1
Federal Light & Traction, com.*	.15	Apr. 1
Federal Light & Traction, pf	1½	Mar. 1
Portland Electric Power, 2d pf	1½	Mar. 1
Southwestern Power & Light, pf	1¾	Mar. 1
Standard Gas & Electric, 8% pf	2	Mar. 15
Timken Roller Bearing	.75	Mar. 5
Timken Roller Bearing, extra	.25	Mar. 5

*Payable in common stock.

Brooklyn Edison Adds 100,000 Meters

Record Growth Last Year Lifts Annual Gross Revenue to $26,000,000 —Exhibits Model Balance Sheet at Close of 1925— Employees Share in Profits

BY PAUL WILLARD GARRETT
Financial Editor New York *Evening Post*

EVIDENCE of the Brooklyn Edison Company's sound earning position may be found in the fact that the utility for a quarter of a century has paid dividends continuously on its common stock, but the present management may take pride in an accomplishment even more unusual. Probably Matthew S. Sloan, president of the company, is no more proud of any item in his new annual report than of that which tells of the addition of more than a hundred thousand meters to the system during 1925. It makes the second successive year that he has been able to report so great an expansion, and, it may be added, no other utility in the history of the industry has been able to add a hundred thousand meters within a year.

No annual report can be expected to record the personal activities of its executives during the year, but the rapid growth in Brooklyn Edison's business is a tribute to the company's energetic president, whose main interest is public relations and whose daily calendar is constantly filled with engagements to meet different Brooklyn delegations.

Through the progressive efforts of the company and the natural growth of the community the number of kilowatt-hours sold yearly has stepped up steadily and rapidly from 325,764,518 in 1921 to 594,576,980 in 1925. In the same period the number of meters has increased from 220,209 to 601,257. It is reckoned that three-fifths of the total energy generated by Brooklyn Edison during last year was supplied by the new Hudson Avenue station, where three 50,000-kw. units now are in operation and where before the end of the current year a fourth unit, of 80,000 kw., will be added. Plans are under way for the installation of another four units as the demand increases.

Gross revenues for the system have risen from $23,422,313 in 1923 to $29,887,300 in 1925. Already the benefits of economies realized through the new Hudson Avenue station are reflected in the relatively greater proportion of gross revenues which the Brooklyn Edison Company is able to turn into net, and as the load at this station increases still greater savings will be shown. It is interesting to note where the $29,887,300 in gross revenues went. No less than $3,385,000, or 11.33 per cent of the total, went for taxes. Operating expenses, of which wages represented about half of the outlay, consumed another 48.62 per cent of the total revenues. Fixed charges, such as interest on the company's debt, took 8.28 per cent and dividends to stockholders another 16.03 per cent of the revenues. That left 14.51 per cent of the gross revenues for reserves and surplus—an excellent showing.

In 1910 the company adopted a system of sharing its profits with its employees, based on length of service. The system provides "that every employee who has been at least two full calendar years in the company's service shall receive at the end of the year, in addition to his regular pay, a percentage of his salary or wages, rising, according to length of service, from one-quarter of the dividend rate paid on the capital stock to the full dividend rate." During 1925 the amount paid in profit sharing by the company reached $368,419.

From the standpoint of conservatism the balance sheet of the Brooklyn Edison Company presents a structure that is somewhat of a model for operating

companies. With fixed capital assets of $124,868,913, not to mention its $10,922,759 in cash and other assets, the company has outstanding $74,010,200 in capital stock and $45,451,000 in bonds. Only now and then do we find a large operating power and light company that has relatively so small an outstanding debt as the Brooklyn Edison Company. The facts that so few bonds are outstanding, relatively, and that the company has no preferred stock help to give the common shares a high investment rank.

Allis-Chalmers Issues Earnings Statement.—The Allis-Chalmers Manufacturing Company in an earnings statement just issued reports sales billed totaling $28,921,357 for the year 1925, as compared with $27,855,524 for the previous year, and bookings in 1925 totaling $28,944,402, against $25,979,420 in 1924. Net profit after taxes amounted to $3,417,368 in 1925, as compared with $3,221,101 during the preceding year. The net profit for 1925 after allowance for preferred dividend of 7 per cent is equivalent to $8.78 per share on the common stock.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday Feb. 13	Low 1926	High 1926
STOCKS			
ABITIBI PWR. & PAPER, com.—no par	k 81⅞	71¼	84⅛
Adirondack Pwr. & Lt.—7% pf.	k103½	....	....
Adirondack Pwr. & Lt.—8% pf.	110	n103	n115
Adirondack Pwr. & Lt., com.—50	m 75	n 31	n 98
Ala. Pwr., pf.	k105½	....	....
Allis-Chalmers Mfg. pf.	109½	109	110
Allis-Chalmers Mfg., com.	k 91	90	94½
Aluminum Co. of Amer., com.	k 64	....	....
Aluminum Co. of Amer. new, pf.	k 98⅛	98½	99⅛
Amer. & Foreign Pwr., pf. 25% pd.	m127	127½	131
Amer. & Foreign Pwr., 7% pf.—no par	k 95½	91	98
Amer. & Foreign Pwr., com.—no par	k 37½	36⅛	42⅛
Amer. Bosch Magneto, com.—no par	k 29	28⅛	34⅛
Amer. Brown Boveri, Elec.	k 43½	43⅛	48⅛
Amer. Brown Boveri Elec. pf.	k 96½	96½	97⅛
Amer. Elec. pwr., pf.	c103½	101¼	105
Amer. Gas & Elec., 6% pf.—no par	k 93½	92⅛	95⅛
Amer. Gas & Elec., com.—no par	k 92½	80	99⅛
Amer. Lt. & Trac., 6% pf.	k114	114	116½
Amer. Lt. & Trac., com.	k249	232	263
Amer. Pwr. & Lt., 6% pf.	k 93½	93⅛	96
Amer. Pwr. & Lt., com.—no par	k 72⅛	68¼	79½
Amer. Pub. Serv., 7% pf.	k 96	....	....
Amer. Pub. Serv., com.	47	n 45	n 90
Amer. Pub. Utilities, 4% pf.	k 85	....	....
Amer. Pub. Utilities, 6% pf.	83	n 71	n 82
Amer. Pub. Utilities, 7% pf.	k 88	....	....
Amer. Pub. Utilities, com.	80	n 70	n103
Amer. States Sec., A	k 8	....	....
Amer. States Sec. B	k 5	....	....
Amer. Superpwr., pf.—25	25½	25	25⅛
Amer. Superpower, pf.	92	n 92	n 95½
Amer. Superpwr., Class A—no par.	k 36	33½	37⅛
Amer. Superpwr., Class B—no par.	k 36½	34⅛	39
Amer. Wtr. Wks. & Elec., 7% pf.	104½	102½	108⅛
Amer. Wtr. Wks. & Elec., com.—20	k 67½	66⅛	74
Anaconda Copper	k 49	46⅛	51
Appalachian Pwr., 7% pf.	101	n 92	n100
Appalachian Pwr., 1st pf., 7%	102	n 95	n101
Appalachian Pwr., com.	80	n 70	n 83
Arizona Pwr., 7% pf.	k 79	....	....
Arizona Pwr. com.	35	n 15	n 34⅛
Arkansas Cent. Pwr., pf., $7—no par	101½	n 97	n102
Arkansas Lt. & Pwr., 7% pf.	k 99½	....	....
Arkansas Lt. & Pwr., com.	100	n 65	n101
Asheville Pwr. & Lt., 7% pf.	l103	100½	104
Assoc. G.&E., 7% pf.—1% extra—50	k 50	....	....
Assoc. Gas & Elec., pf.—$6—no par	k 80	....	....
Assoc. Gas & Elec., Class A—no par	k 31⅛	31¼	35½
BABCOCK & WILCOX, com.	k143	....	....
Binghamton Lt., Ht. & Pwr., pf.	105	n 90	n101
Birmingham Elec. pf.—$7—no par	103	n 98	n103
Blackstone Valley Gas & Elec., pf.	102	n 95	n100
Blackstone Valley G.&E., com.—50	100	....	....
Blaw-Knox, com.	g 54	53⅛	56
Brazilian Trac., Lt. & Pwr., com.	f 93½	....	....
Broad River Pwr., pf.	94	n 90	n 97
Brooklyn Edison, com.	k142	133½	146⅛
Buffalo Gen. Elec., com.—no par	m 58	n 50	n 77
Buffalo, Niagara & East. Pwr., pf.—25	l 24½	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par	l 35½	....	....
CALIFORNIA ELEC. GENERATING, pf.	92	n 80	n 93
California Ry. & Pwr., pf.	88	n 88	n100
Carolina Pwr. & Lt., pf.—$7—no par	105½	n100	n107
Carolina Pwr. & Lt., com.	420	n290	n456½
Cent. & S. W. Ut. 7% pf.—no par	a 92⅛	89½	94
Cent. & S. W. Ut., pr. in. pf.—no par	m 99½	99½	99⅛
Central Aris. Lt. & Pwr., pf.	102	n100	n106
Central Ark. Ry. & Lt., 7% pf.	k100	....	....
Central Ill. Pub. Serv., 6% pf.	89	n 84	n 93
Central Ind. Pwr., 7% pf.	91	n 88	n 95
Central Pwr. & Lt., pf.	k 95½	....	....
Central States Elec., 7% pf.	k 93½	....	....
Central States Elec., com.	200	n 70	n250
Century Elec., com.	m103	n103	n110
Chicago Fuse Mfg., com., no par	a 35	32	35
Cincinnati Gas & Elec., com.	g 92	89	92⅛
Cities Service, 6% pf.	k 83½	....	....
Cities Service, pf. B—10	k 71	....	....
Cities Service, pf. BB—100	k 77	....	....
Cities Service, com.—20	k 38⅛	....	....
Cities Service, Bks. Shrs.—10	k 17½	....	....
Clarion River Pwr., pf.	93	n 91	n 96
Cleveland Elec. Illg., 6% pf.	102	n101	n105
Cleveland Elec., Illg., com.	k240	....	....
Colorado Pwr., 7% pf.	k 96	....	....
Columbia Gas & Elec., 7% pf.	k114½	113	115
Columbia Gas & E., com.—no par	k 83⅛	83¼	90
Columbia Ry., Gas & Elec., 6% pf.	95	n 90	n 90
Columbus Elec. & Pwr., 2d pf.	k102	....	....
Columbus Elec. & Pwr., com.	k168	....	....
Columbus Ry., Pwr. & Lt., pf. A	98	n 86	n 99
Columbus Ry. Pwr. & Lt., pf. B	92	n 80	n 85
Col. Ry., Pwr. & Lt., com.—no par	82	n 70	n 85
Commonwealth Edison, com.	a142½	139½	144
Commonwealth Pwr., 6% pf.	k 86⅛	85	87⅜
Commonwealth Pwr., com—no par	k 40	39	42⅛
Conn. Lt. & Pwr., 8% pf.	118	n115	n118
Conn. Lt. & Pwr., 7% pf.	110	n105	n110
Cons. Gas of N. Y., pf.—50	k 58½	....	....
Cons. Gas of N.Y., com.—no par	k101½	94½	102⅛
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	e103½	102	103½
Cons. Gas, Elec. Lt. & Pwr. of Balti 6½% pf.	e109½	108½	110
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	e114½	110½	114½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	e128	124	128
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par	e 57½	45	57½
Cons. Utilities of Dela., 7% pf.	m 85	n 80	n 84
Consumers Pwr., 6% pf.	97	n 90	n 97
Consumers Pwr., 6.6% pf.	102½	n 97	n102
Continental Gas & Elec., 7% pfc. pf	k100	....	....
Continental Gas & Elec., 7% pr. pf.	97½	n 89	n 97
Continental G.&E., com.—no par	143	n 77	n152
Crocker Wheeler, com.	14	n 9	n 28
Crocker Wheeler, pf.	45	n 47	n 80
DALLAS PWR. & LT., 7% pf.	102	n100	n102½
Dayton Pwr. & Lt., 6% pf.	97	n 88	n100
Dayton Pwr. & Lt., com.	420	n180	n460
Detroit Edison, com.	137½	133	141⅛
Dubilier Condenser & Radio, com. no par	k 8	7½	11
Dubuque Elec., 7% pf.	94	n 80	n 90
Duquesne Lt., 7% pf.	k113	112½	114
EAST. N. Y. UTIL. pf.	70	n 71	n 80
Eastern New York Util., com.	55	n 52	n 65
Eastern States Power	k 29	....	....
Eastern States Pwr., pf. with warrants	m120	....	....
Eastern States Pwr., pf. without warrants	k 91	....	....
Eastern Tex. Elec., 7% pf.	k100	....	....
East. Tex. Elec., com.—no par	k 98	....	....
Edison Elec. Illum. of Boston, com.	d220½	207	250
E. Paso Elec., com.—no par	k 85	....	....
E. Paso Elec. pf.	k102	....	....
Elec. Bond & Share, 6% pf.	l105½	103½	107⅛
E. Bd. & Share Sec., com.—no par.	l80	79	86
Elec. Investors, 6% pf.—no par	92	n 95	n 96
Elec. Investors, com.—no par	k 66½	66	74⅛
Elec. Investors, 10% pd. receipts	50	n 15	n 62
Elec. Pwr. & Lt., ctfs. pf.	k 96½	91½	97⅛
Elec. Pwr. & Lt., ctfs., 40% pd.	k110½	105½	115
Elec. Pwr. & Lt., ctfs. full pd.	112	107	110½
Elec. Pwr. & Lt., ctfs., com.—no par	k 31½	30	34½
Elec. Ry. Securities, com.—no par	k 6	4½	10
Elec. Refrig.	k 77	75½	90½
Elec. Storage Battery, com.—no par	k 78	73	79½
Elmira Wtr., Lt. & R. R., 7% pf.	99	n 93	n 98
Emerson Elec. pf.	m103½	100	104½
Empire Dist. Elec., 6% pf.	80	n 78	n 85
Empire Pwr., A	k 31	....	....
Eng. Pub. Serv., pf.—no par	k100½	99½	102⅜
Engr. Pub. Serv., com.—no par	k 27⅛	24	29⅛
Eureka Vac. Cleaner, com.—no par	k 50	47	53⅛
FAIRBANKS MORSE, com—no par	k 56⅛	51	59⅛
Fairbanks Morse, pf.	116	108½	115
Federal Lt. & Trac., com.	k 37½	35½	39⅛
Federal Light & Traction, pf.	87	87	89
Federal Utilities, pf.	k 75	....	....
Federal Utilities, com.	k 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	l105½	105	107
GALVESTON-HOUSTON ELEC., 6% pf.	k 60	....	....
Galveston-Hstn El., com.	k 21	....	....
Gen. Elec., com.	k378½	323	384
Gen. Elec., special—10	k 11½	11	11⅛
Gen. Gas & Elec., A	k 52	51½	59
Gen. Gas & Elec., pf. A	m 98⅛	98½	99⅛
Gen. G.&E., (Del.) com. A no par.	51½	n 42	n 64⅛
Gen. G.&E., (Del.) com. B no par.	40	n 40	n 62
Gen. G.&E., (Del.) A pf. $8—no par	108½	n 90	n111
Gen. G.&E., (Del.) A pf. $7—no par	97½	n 97½	n100
Gen. G.&E., (Del.) B pf.	95½	n 88	n 97½
Ga. Lt., Pwr. & Rys., 6% pf.	85	n 74	n 85
Ga. Lt., Pwr. & Rys., com.	59	n 25	n 74
Ga. Ry. & Elec., 5% pf.	m 70	n 78½	n 84½
Ga. Ry. & Elec., com.	m126	n115½	n115½
Ga. Ry. & Pwr., 8% pf.	112	n101	n114
Ga. Ry. & Pwr., 7% pf.	101	n100	n102½
Ga. Ry. & Pwr., 4% pf.	140	n 62	n150
Ga. Ry. & Pwr., com.	k138	....	....
Gt. Western Pwr., 7% pf.	h101	....	....
HAVANA ELEC. UTIL., com.	44	43½	44⅛
Havana Elec. Util., pf.	71	68⅛	71
Hurley Machine, com.—no par	m 50½	44¼	51
IDAHO PWR., 7% pf.	102½	n 97½	n102
Ill. No. Utilities, 6% pf.	k 88	....	....
Ill. Pwr. & Lt., 7% pf.	k 97	....	....
Ingersoll Rand.	98	90	105
Int. Combt. Engr., com.—no par.	k 53½	50½	64½
Int. Utilities, class A—no par.	k 37½	....	....
Int. Utilities, class B—no par.	k 7	7½	9⅛
Interstate Pwr., pf., $7 no par.	92	n 90	n 98
Interstate Pub. Serv., 7% pf.	96½	n 90	n100
Iowa Ry. & Lt., 7% pf.	97	n 92	n100
JERSEY CENTRAL PWR. & LT. 7% pf.	95½	n 90	n 96
Jersey Central Pwr. & Lt., com.—no par	45	n 15	n 50
Johns-Manville, com.—no par	150½	142½	159
KANSAS CITY PWR. & LT., pf.	m108½	107½	109
Kansas Gas & Elec., 7% pf.	l100½	99½	102
Kelvinator Corp., com.—no par	83	78½	89⅛
Kentucky Hydro-Elec., pf.	a 94	92	95
Kentucky Sec., 6% pf.	75	n 67	n 78
Kentucky Sec., com.	k 90	....	....
Kentucky Utilities, 6% pf.	90	n 82	n 95
Keystone Pwr. & Lt. 7% pf.	96	n 90	n 95
Kings County Ltg., 7% pf.	103	n 98	n101
Kings County, Ltg., 8% pf.	104	n103	n106
LACLEDE GAS LT., com.	162	160½	168
Lehigh Pwr. Sec., com.—no par.	k 19½	19½	23
Long Island Ltg., 7% pf.	105	n100	n105
Long Island Ltg., com.—no par.	145	n 60	n142
Los Angeles Gas & Elec., 6% pf.	95½	n 96	n 98
Louisville Gas & Elec., Class. A	k 25½	22⅛	26⅛
MANHATTAN ELEC. SUPPLY	k 72½	56	76⅛
Manila Elec., com.—no par.	32	31½	32⅛
Maytag Mfg., com.	k 21⅞	21⅛	23⅛
Memphis Pwr. & Lt., pf., $7, no par	103	n 98½	n102
Metro. Edison, pf.—$6—no par.	92½	n 92	n 96
Metropolitan Edison, pf., $7, no par.	102½	n100	n110
Metropolitan Edison, com., no par.	45	n 45	n 50
Middle West Utilities, 7% pf.	a111½	97½	111½
Middle West Utilities, 7% pr. lien pf.	a123½	106½	123⅛
Middle West Utilities, com.—no par.	a134½	115½	134½
Midland Utilities, pr. ln. pf.	a 99½	99	100
Midland Utilities pf. A	a 96½	96	96½
Milwaukee Elec. Ry. & Lt., 7% pf.	97	96	105
Milwaukee Elec. Ry. & Lt., 6% pf.	87	83½	87
Minn. Pwr. & Lt., 7% pf.	l102	100½	103½
Miss. Pwr. & Lt., pf.	m102	....	....
Miss. River Pwr., 6% pf.	95	n 87½	n 94
Miss. River Pwr., com.	k 60	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par	103	n101	n105
Mohawk Hudson Pwr., 2nd pf.—$7—no par	k 96	....	....
Mohawk Hudson Pwr., com.—no par	k 24	23	26⅛
Montana Pwr., pf.	m 118	112½	118
Montana Pwr., com.	k 79½	77½	83⅛
Montreal Pwr., com.	f 224	....	....
Mountain States Pwr., pf.	k 95	....	....
Mountain States Pwr., com.	k 24	....	....
NASSAU & SUFFOLK, LTG., pf.	93	n 88	n 95
National Carbon, com.	m124	n120	n130
National Carbon, pf.	a127	126	127½
National Elec. Pwr., pf.	a 93½	93	95½
National Electric Pwr-A	a 25	24½	26⅛
Nat.-Lt., Ht. & Pwr., com.—no par.	24	n 11	n 30
National Lt., Ht. & Pwr., 5% pf.	71	n 40	n 72
National Pwr. & Lt., pf., $7—no par.	k101½	100½	102½
National Pwr. & Lt., com.—no par.	k 31⅛	31	38⅛
National Pub. Serv., 7% pf.	91	n 90	n 96
National Pub. Serv., ptc. pf.	95	n 93	n 97½
National Pub. Serv., A com.—no par	k 21	21¼	24
National Pub. Serv., B com.—no par	14	13½	17⅛
Nebraska Pwr., 7% pf.	l 103½	103	105⅛
Nevada-Calif. Elec., com.	m 35½	30½	44⅛
New Brunswick Pwr., pf.	35	n 30	n 40
New England Pub. Serv., pr. ln. pf.	98	n 97½	n 99
New England Pub. Serv., pf.	92	n 95½	n 97
N. J. Pwr. & Lt., 7% pf.	104	n 92	n102
New Orleans Pub. Serv., 7% pf.	101½	n 94	n102
New Orleans Pub. Serv., com.—no par.	m 30	n 31	n 38⅛
N. Y. Central Elec., 7% pf.	99	n 96	n101
Newport News & Hampton Ry., Gas & Elec., com.	108	n 85	n100
Newport News & Hampton Ry., Gas & Elec., pf.	108	n 90	n105
Niagara Falls Pwr., 7% pf.—25	28	28	28⅛
Niagara, Lock. & Ont. Pwr., 7% pf.	m101	n101½	n110
Niagara, Lock. & Ont. Pwr., com.—no par	m 60	n 60	n 73
Niser Corp., A.—no par	m 84½	n 37	n 84½
Niser Corp., B.—no par	80½	76	89½
No. Amer., 6% pf.—50	k 50	49	50½
No. Amer., com.—10	k 64½	63½	67
No. Amer. Edison pf.—no par	k 94	92½	95½
No. Amer., Lt. & Pwr., pf.	88	n 87	n 91
N.C. Pub. Serv., pf.—$7—no par.	k 91	....	....
Northeastern Pwr., com.	k 32½	31⅛	36⅛
No. Indiana Gas & Elec., pf. A	98	n 96	n 98⅛
No. N. Y. Utilities, 7% pf.	k102½	....	....
No. Ohio Pwr., com.—no par.	k 19½	15½	26⅛
No. Ohio Trac. & Lt., 6% pf.	80	n 64	n 75
No. Ohio Trac. & Lt., 7% pf.	89	n 85½	n 88
No. Ont. Lt. & Pwr., pf.	k 78	....	....
No. Ont. Lt. & Pwr., com.	63½	n 41	n 52
No. States Pwr., 7% pf.	k100½	....	....
No. States Pwr. com.	k128½	125½	136⅛
No. Texas Elec., 6% pf.	k 58	....	....
No. Texas Elec., com.	k 40	....	....
OHIO BRASS, com. B—no par	74	n 72	n 79
Ohio Brass, pf.	99	n 92	n102
Ohio Gas & Elec., 7% pf.	90	n 87	n100
Ohio Pwr., 6% pf.	93	n 85	n 95
Ohio Pub. Serv., 6% pf.	89	n 88	n 93
Ohio Pub. Serv., 7% pf.	98½	n 97	n100
Ohio River Edison, pf.	99½	n 93½	n100½
Oklahoma Gas & Elec., pf.	k 95	....	....
PACIFIC GAS & ELEC., 6% pf.	k 98	....	....
Pacific Gas & Elec. com.	k130	126½	132½
Pacific Pwr. & Lt., 7% pf.	l100	98	101½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Tuesday, Feb. 16. lBid, low, high, Wednesday, Feb. 17. mLatest quotations available. n1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday Feb. 13	Low 1926	High 1926
STOCKS—Continued			
Parr Shoals Pwr., 6% pf.	92	*n* 90	*n*100
Penn Central Lt. & Pwr., pf.—no par	*c* 73½	72½	73½
Penn-Ohio Elec., 7% pf.	93	*n* 83½	*n* 96
Penn-Ohio Pwr. & Lt., 7% pf.	94	*n* 91	*n*100
Penn-Ohio Pwr. & Lt., 8% pf.	101	*n*101	*n*110
Penn Pwr. & Lt.—$7—no par.	*l*105½	103	106
Penn Pub. Serv., 7% pf.	98	*n* 90	*n*100
Penn Pub. Serv., 6% pf.	85	*n* 80	*n* 90
Penn Wtr. & Pwr., com.	*e*165	160½	171
Phila. Co., pf.—50.	*c* 49½	48	49½
Phila. Co., com.—50.	*c* 67	66½	67½
Phila. Elec., com.—25.	*c* 63½	54½	67½
Pittsburgh Utilities, pf.—10.	*k* 16	15½	16½
Portland Elec. Pwr., 7% pf.	97½	*n* 95	*n* 99
Portland Elec. Pwr., 6% pf.	72½	*n* 70	*n* 80
Portland Elec. Pwr., com.	*k* 47	....	....
Portland Ry., Lt. & Pwr.,pf.	*m* 72½	....	....
Portland Ry., Lt. & Pwr., com.	*m* 49	....	....
Potomac Elec. Pwr., pf.	*j*108	....	....
Pwr. Corp. of N. Y., 7% pf.	*m*110	*n* 96	*n*112
Pwr. Corp. of N.Y., com—no par.	*k* 80	78½	90½
Pwr. Sec., pf.—no par.	*k* 21	....	....
Pwr. Sec., com.—no par	*k*10½	10	10½
Pub. Serv. of N. J., 7% pf.	108	103½	109
Pub. Serv. of N. J., 8% pf.	118	115½	119
Pub. Serv. of N. J., com.—no par.	*k* 85½	79½	92½
Pub. Serv. of No. Ill., 6% pf.	*a*101½	100½	102½
Public Serv. of No. Ill., 7% pf.	*a*114½	112	115
Pub. Serv. of No. Ill., com.—no par	*a*135	130	137
Pub. Serv. of No. Ill., com.	*a*134	130	135
Pub. Serv. of Okla., 7% pf.	92	*n* 87	*n* 95
Pub. Serv. Elec. & Gas, 6% pf.	*k* 99	97	99½
Puget Sound Pwr. & Lt., 7% pf.	*k*106	....	....
Puget Sound Pwr. & Lt., 6% pf.	*k* 84	....	....
Puget Sound Pwr. & Lt., com.	*k*56	....	....
RADIO CORP. OF AM., pf.—50.	*k* 46½	45½	47½
Radio Corp. of Amer., com.—no par.	*k* 41½	41	46½
Republic Ry. & Lt., pf.	*k*108	....	....
Republic Ry. & Lt., com.	93	*n* 49	*n* 67
Rochester Gas & Elec., 5% pf.	95	*n* 80	*n* 98
Rochester Gas & Elec., 6% pf.	100	*n* 96	*n*100
Rochester Gas & Elec., 7% pf.	104	*n*103	*n*106½
ST. JOSEPH RY., LT., HT. & PWR., pf.	65	*n* 60	*n* 65
Servel Corp., Class A	*k* 27½	26½	30½
Servel Corp., Class B—no par.	*k* 60	....	....
Sierra Pacific Elec., com.	*k* 24½	25	28½
Sioux City Gas & Elec., 7% pf.	96	*n* 97½	*n* 99½
S. E. Pwr. & Lt., 7% pf.—no par.	99	*n* 90	*n*100
S. E. Pwr. & Lt. com.—no par.	*k* 38	37½	46½
So. Calif. Edison, 8% pf.	135	*n*115	*n*128
So. Calif. Edison, 7% pf.	*k*111	....	....
So. Calif. Edison, 6% pf.	*k* 98	....	....
So. Calif. Edison, com.	*k*133½	128	142
Southern Cities Utilities, 7% pf.	88	*n* 77	*n*100
Southern Cities Utilities, com.	*k* 48	....	....
Southern Pwr. & Lt. of Md., pf.	*m*107	....	....
Southern Pwr. & Lt. of Md., com.	*m* 32	....	....
Southwestern Lt. & Pwr., A.	*k* 55	....	....
Southwestern Lt. & Pwr., B.	*k* 42	....	....
Southwestern Lt. & Pwr., 6% pf.	*k* 80	....	....
Southwestern Pwr. & Lt., 7% pf.	*k*102	....	....
Springfield (Mo.) Ry. & Lt., 7% pf.	96	*n* 92	*n* 93
Standard Gas & Elec., 8% pf.	*k* 56½	54½	*k* 57½
Standard Gas & Elec., 7% pf.	*k*101	....	....
Standard Gas & Elec., com.—no par.	*k* 63½	55½	69
Standard Pwr. & Lt., 7% pf.	*k* 91	....	....
Superheater, com.—no par.	*k*142	....	....
Syracuse Lighting, 7% pf.	105	*n*103	*n*107
Syracuse Lighting, 8% pf.	118	....	....
Syracuse Lighting, com.	265	*n*115	*n*265
TAMPA ELEC., com.	*k*315½	292	315½
Tenn. Elec. Pwr., 6% pf.	*k* 87	....	....
Tenn. Elec. Pwr., 7% pf.	*k*100½	....	....
Tenn. Elec. Pwr., pf.—$6—no par.	*m* 80	....	....
Tenn. Elec. Pwr., com.—no par.	*m* 65	....	....
Terre Haute, Ind. & East Trac., pf.	27	*n* 22	*n* 35
Terre Haute, Ind. & East. Trac., com	3	2½	....
Tex. Pwr. & Lt., 7% pf.	*l*103½	102	104½
Tide Water Pwr., 8% pf.	*k*100	....	....
Timken Roller Bearing, com—no par	*k* 54½	52½	56½
Toledo Edison, 8% pf.	114	*n*109	*n*114
Toledo Edison, 7% pf.	*k*101½	....	....
Toledo Edison, com.	*m* 25	*n* 21	*n* 25
Tri-City Ry. & Lt., 6% pf.	88½	*n* 82	*n* 85
UNITED GAS & ELEC., 6% pf..	95½	*n* 80	*n* 94
United Gas & Elec., com.—no par.	63	*n* 26	*n* 57½
United Gas & Elec. (N. J.), 5% pf....	70	*n* 55	*n* 65
United Gas Impr.—50.	*c*135½	119	144½
United Lt. & Pwr., pf.—$4—no par.	49½	*n* 41	*n* 51
United L. & P. pf.—$6.50—no par..	88½	*n* 83	*n* 99
United Lt. & Pwr., com., A—no par	138	*n* 42	*n*166½
United Lt. & Pwr., com., B—no par	155	*n* 49	*n*100
Utah Pwr. & Lt., 7% pf.	*l*102½	99	103
Utica Gas & Elec., 7% pf.	105	*n*100	*n*104
Utica Gas & Elec., com.	200	*n*160	*n*200
Utilities Pwr. & Lt., 7% pf.	92	*n* 90	*n* 97
Utilities Pwr. & Lt., com. B—no par.	*k* 16½	15½	17½
VERMONT HYDRO - ELEC., 7% pf.	95	*n* 87	*n* 96
Virginia Pwr., 7% pf.	102	*n* 94	*n*107
Virginia Pwr., com.	65	*n* 65	*n* 92
Virginia Ry. & Pwr., com.	*m*149	*n* 64½	*n*150
WAGNER ELEC., pf.	*b* 83	82½	85
Wagner Elec., com.—no par.	*b* 30½	30	34½
Washington Ry. & Elec., com.	*f*226	....	....
Washington Ry. & Elec., pf.	*j* 90½	....	....
Washington Wtr. Pwr., com.	130	*n*110	*n*140
West Mo. Pwr., 7% pf.	*k* 91	....	....
West Penn., 7% pf. tem. ctfs.	100½	96½	99½
West Penn, com.	125½	123	130
West Penn Elec., pf.	100	96½	100
West Penn Elec., Class A	*k* 96	88½	97
West Penn Pwr., pf.	108½	108½	112
West Va. Lt., Ht. & Pwr., 7% pf...	95	*n* 94½	*n* 96½
West Va. Utilities, 7% pf.—50.	43	*n* 38	*n* 47
Western Pwr., 7% pf.	*k* 98½	96	99
Western Pwr., com.—no par.	*m* 80	*n* 34	*n*102
Western States Gas & Elec., 7% pf.	89	*n* 82	*n* 92
Western States Gas & Elec., com.	*k* 19½	....	....
Westinghouse El. & Mfg., com—50.	*k* 76½	72	79½
Weston Elec. Instrument, Class. A..	*k* 30½	27½	30½
Weston Elec. Instrument, com.	*k* 19	15½	19
Wheeling Elec., pf.	91	*n* 88	*n* 93½
Wis.-Minn. Lt. & Pwr., 7% pf.	*m* 90	....	....
Wis. Pwr., Lt. & Ht., 7% pf.	85	*n* 85	*n* 90
Worthington Pump, pf. A	77	77	80
Worthington Pump, pf. B	64	60	64½
Worthington Pump. com.	*k* 39½	37½	44½
YADKIN RIVER PWR., 7% pf...	*l*104	102	105
Yale & Towne, com.—25.	63½	62½	64½

BONDS

Companies		Bid Price Saturday Feb. 13	Low 1926	High 1926
ABITIBI PWR., & PAPER.	6s	1940 *k*100	....	....
Adir. Elec. Pwr.	5s	1962 *k*100½	....	....
Adir. Pwr. & Lt.	6s	1950 *k*105½	....	....
Adir. Pwr. & Lt.	5s	1930 97	*n* 94	*n*98
Ala. Pwr.	5s	1946 99½	*n* 96	*n*100
Ala. Pwr.	5s	1951 98½	*n* 92½	*n* 97½
Ala. Pwr.	6s	1951 105	*n*101½	*n*105½
Ala. Trac., Lt. & Pwr.	5s	1962 120	*n* 86	*n*115½
Aluminum Co. of Amer.	7s	1933 *k*106½	106½	107
Amer. Bosch Magneto.	8s	1936 *m*103	....	....
Amer. Gas & Elec.	5s	2007 92	*n* 90	*n* 93½
Amer. Gas & Elec.	6s	2014 *k* 99½	98	99½
Amer. Pwr. & Lt.	6s	2016 *k* 97½	96	98
Amer. Pub. Serv.	6s	1942 99½	*n* 94	*n* 99½
Amer. Wtr. Wks. & Elec.	5s	1934 97½	95½	97½
Amer. Wtr. Wks. & Elec.	6s	1975 *k* 94½	93½	94½
Anaconda Copper	6s	1929 *k*103½	102½	103½
Anaconda Copper	6s	1953 *k*103½	101½	103½
Anaconda Copper	7s	1938 *k*106½	....	....
Appalachian Pwr.	5s	1941 *k* 98½	....	....
Appalachian Pwr.	6s	2024 94	*n* 87	*n* 94½
Appalachian Pwr.	7s	1936 105½	*n*105	*n*106½
Arizona Pwr.	6s	1933 100	*n* 97½	*n*101
Arizona Pwr.	6s	1947 96	*n* 90	*n* 96½
Ark. Central Pwr.	6s	1948 102½	*n* 98½	*n*102½
Ark. Lt. & Pwr.	6s	1945 *k*103½	....	....
Ark. Lt. & Pwr.	6s	1954 100½	*n* 92½	*n* 99½
Assoc. Gas & Elec.	6s	1965 *k* 93½	93½	94½
Assoc. Gas & Elec.	6½s	1954 *k*100	....	....
BINGHAMTON LT., HT. & PWR.	5s	1946 *k* 99½	....	....
Birmingham Elec.	6s	1954 103	*n* 99	*n*103
Birmingham Ry., L. & P.	4½s	1954 90	*n* 85	*n* 89½
Broad River Pwr.	6½s	1934 100½	*n* 99	*n*102
Brooklyn Edison.	5s	1949 *k*103½	....	....
Brooklyn Edison.	6s	1930 103½	103½	105½
Buffalo Gen. Elec. 1st.	5s	1939 102	*n*100½	*n*102½
Buffalo G. E., 1st & Ref.	5s	1939 101½	*n*100	*n*101½
Buffalo G. E.	5s	1956 *k*101	99½	101½
Burlington Ry. & Lt.	5s	1932 96½	*n* 90	*n* 96
Butte Elec. & Pwr.	5s	1951 *k*100½	....	....
CALIF. ELEC. GEN.	5s	1948 *k*100½	....	....
Calif. Gas & Elec.	5s	1937 100	100½	101½
Calumet Gas & Elec.	5½s	1960 97½	*n* 97	*n* 98½
Canadian Lt. & Pwr.	5s	1949 59	*n* 36	*n* 62
Canton Elec.	5s	1937 100	*n* 99	*n*100½
Carolina Pwr. & Lt.	5s	1938 100½	*n* 98½	*n*100½
Carolina Pwr. & Lt.	6s	1953 *k*104½	*n*103½	*n*105
Cedar Rap. Mfg. & Pwr.	5s	1953 99½	*n* 98½	*n*100½
Central Ark. Ry. & Lt.	5s	1928 99½	*n* 98½	*n*100
Central Ga. Pwr.	5s	1938 95½	*n* 93	*n* 97
Central Ill. Lt.	5s	1943 *k* 98½	....	....
Central Ill. Pub. Serv.	5s	1952 90½	*n* 84½	*n* 92½
Central Ill. Pub. Serv.	5½s	1950 95½	*n* 96½	*n* 98
Central Ill. Pub. Serv.	6s	1944 99½	*n* 96½	*n*101½
Central Ind. Pwr.	6s	1947 98½	*n* 95½	*n* 99½
Central Ia. Pwr. & Lt.	6s	1944 100½	*n* 97	*n*101
Central Maine Power.	5s	1939 98½	*n* 98½	*n*100
Central N. Y. Gas & El.	5s	1941 *k* 98½	....	....
Central Pwr. & Lt.	6s	1946 101½	*n* 97½	*n*101½
Central Pwr. & Lt.	6½s	1952 *k*101½	....	....
Central States Elec.	5s	1926 *m* 99	....	....
Chattanooga Ry. & Lt.	5s	1956 84	*n* 81	*n* 85
Cincinnati Gas & Elec.	5s	1956 103	102½	103
Cincinnati Gas & Elec.	5½s	1961 104½	102½	104½
Cities Service.	6s	1966 *k* 93½	92½	93½
Cities Service.	7aB	1966 *k*180½	178	180½
Cities Service.	7aC	1966 *k*126½	125½	127
Cities Service.	7aD	1966 *k*102	101½	102
Cities Service.	7aE	1966 *k*108	....	....
Cities Service Pwr. & Lt.	6s	1948 *k* 94½	93½	94½
City L. & T., Sedalia, Mo	5s	1952 84	*n* 74	*n* 85½
Cleveland Elec. Illum.	5s	1939 102½	*n*100	*n*103
Cleveland Elec. Illum.	5s	1954 *k*102½	....	....
Cleveland Elec. Illum.	7s	1941 110	*n*109	*n*111½
Colorado Pwr.	5s	1953 96½	*n* 93	*n* 96½
Columbia Gas & Elec.	5s	1927 99½	*n* 99½	*n*101
Columbia Ry., Gas & El.	5s	1936 92½	*n* 92½	*n* 95
Columbus, Delа. & Marion Elec.	5s	1937 84	*n* 83	*n* 88
Columbus, Delа. & Marion Elec.	6s	1937 94	*n* 91	*n* 98
Columbus Elec. & Pwr.	6s	1947 *k*102	....	....
Columbus Ry., Pwr. & Lt.	5s	1940 *k* 95	....	....
Columbus Ry., Pwr. & Lt.	6s	1941 *k*102	....	....
Commonwealth Edison.	5s	1943 *k*102½	....	....
Commonwealth Edison.	5s	1953 100	*n* 98½	*n*101
Commonwealth Edison.	5s	1954 *k*100	....	....
Commonwealth Pwr.	5s	1939 *k* 91½	....	....
Commonwealth Pwr.	6s	1972 *k* 95	....	....
Commonwealth Pwr.	6s	1947 105	102½	105
Community Pwr. & Lt.	6s	1950 98½	*n* 94½	*n* 99
Conn. Ry. & Ltg.	4½s	1951 91½	91½	92
Consol. Cities Lt., Pwr. & Trac.	5s	1962 80½	*n* 75½	*n* 82½
Consol. Elec.	5s	1955 98	*n* 94	*n* 98½
Consol. Gas of N. Y.	5½s	1945 105½	104½	105½
Con. Gas. Elec. Lt. & Pwr. of Balti.	4½s	1935 *c* 97½	97½	98
Con. Gas. Elec. Lt. & Pwr. of Balti. (notes)	6s	1949 *c*106½	105½	107
Con. Gas. Elec. Lt. & Pwr. of Balti.	5s	1965 *m*101	100	101
Con. Gas. Elec. Lt. & Pwr. of Balti. (notes)	5½s	1952 *c*105½	104½	105½
Consumers Elec. L. & P..	5s	1936 *k* 97	....	....
Consumers Pwr.	5s	1936 *k*100½	....	....
Consumers Pwr.	5s	1952 100½	97½	100½
Consumers Pwr.	5½s	1954 *k*103½	....	....
Continental Gas & Elec.	5s	1927 *k*100	....	....
Continental Gas & Elec.	6s	1947 *k*100½	....	....
Continental Gas & Elec.	6½s	1964 *k* 99	....	....
Continental Gas & Elec.	7s	1954 *k*112	....	....
Cumberland County P.&L.	5s	1942 95	*n* 92	*n* 96½
DALLAS PWR. & LT.	6s	1949 104	*n*103	*n*105½
Dayton Ltg.	5s	1937 100	*n* 98½	*n*100½
Dayton Pwr. & Lt.	5s	1941 *k* 99½	....	....
Defiance Gas & Elec.	5s	1942 98½	*n* 88½	*n* 97½
Denver Gas & Elec.	5s	1949 98½	*n* 97½	*n*100
Denver Gas & Elec. Lt.	5s	1951 94½	94	95½
Des Moines Elec.	5s	1938 99	*n* 98	*n*100½
Detroit Edison.	5s	1933 102	101	102
Detroit Edison.	5s	1940 102½	100½	102½
Detroit Edison.	5s	1949 101½	100	102½
Detroit Edison.	5s	1955 100½	100½	101½
Detroit Edison.	6s	1932 *m*135	135	135
Detroit Edison.	6s	1940 *k*107½	....	....
Detroit Edison.	7s	1928 *m*134	....	....
Detroit Edison.	7s	1929 *m*138½	....	....
Detroit Edison.	7s	1930 138½	134½	138½
Dominion Pwr. & Trans.	5s	1932 95½	*n* 95½	*n* 98½
Driver-Harris.	8s	1931 96	*n* 88	*n* 97
Dubuque Elec.	6s	1942 102½	*n* 97½	*n* 102
Duke-Price Pwr.	6s	1949 102½	*n* 98½	*n*103
Duquesne Lt.	5s	1949 106½	105½	107
Duquesne Lt.	5½s	1949 105½	105	106½
Durham Pub. Serv.	7s	1949 100	*n* 97½	*n*101½
EAST PENN. ELEC.	6s	1953 105	*n*100½	*n*105½
East Oregon Lt. & Pwr.	6s	1929 100½	*n* 97½	*n*100½
East. Tex. Elec.	5s	1942 *k* 96	....	....
Economy Lt. & Pwr.	5s	1956 99	*n* 96	*n* 99½
Edison Elec. Illum. of Boston (notes)	4½s	1928 99½	*n* 98	*n*100½
Edison Elec. Illum. of Bklyn.	4s	1939 99½	93	99½
Edison El. Illum. (N.Y.).	5s	1995 104½	103	104½
El Paso Elec.	5s	1932 *k*102	....	....
El Paso Elec.	5s	1950 95	*n* 95	*n*96
El. Pwr. Corp. (Germany)	6½s	1950 87½	85½	87½
Elec. Refrigeration.	6s	1936 *k*104½	104	107
Elmira Wtr., Lt. & R.R.	5s	1956 96	*n* 92½	*n* 97
Empire Dist. Elec.	5s	1949 92½	*n* 86½	*n* 93
Erie Ltg.	5s	1967 99½	*n* 95½	*n* 99½
Evansville G. & El. Lt.	5s	1932 99	*n* 96	*n*100
FEDERAL LT. & TRAC.	5s	1942 94½	93½	95
Federal Lt. & Trac.	6s	1942 103½	101½	103½
Federal Lt. & Trac.	6s	1954 94½	93	94½
Florida Power & Light.	5s	1954 *k* 95½	93½	93½
Florida Publ. Service.	6s	1955 96½	*n* 96½	*n* 99
Florida Public Service.	6½s	1949 99½	*n* 99	*n*103
Ft. Smith Lt. & Trac.	5s	1936 75½	75½	78
Ft. Worth Pwr. & Lt.	5s	1931 99½	*n* 99	*n*100½
GALVESTON ELEC.	5s	1940 90	*n* 86½	*n* 93½
General Elec.	3½s	1942 87	87	88½
Georgia Carolina Pwr.	5s	1952 87½	*n* 82	*n*90
Ga. Lt., Pwr. & Rys.	5s	1941 89	*n* 86½	*n* 90½
Ga. Ry. & Elec.	5s	1932 99½	*n* 98½	*n*100½
Ga. Ry. & Elec.	5s	1949 95	*n* 88	*n* 94½
Ga. Ry. & Pwr.	5s	1954 97	*n* 89½	*n* 96
Ga. Ry. & Pwr.	6s	1947 *k*104	....	....
Ga. Ry. & Pwr.	7s	1941 *k*105	....	....
German Gen. Elec.	7s	1945 98½	95	98½
German Gen. Elec.	6½s	1940 97½	94	97½
Great Cons. Elec. Pwr. (Japan)	6½	1950 *k* 86	85½	86
Great Cons. Elec. Pwr. (Japan)	7s	1944 92	91	92½
Great Falls Pwr.	5s	1940 101½	101½	103½
Great Northern Pwr.	5s	1935 99½	*n* 96	*n*100
Great Western Pwr.	5s	1946 *k* 99½	....	....
Great Western Pwr.	5½s	1955 99½	*n* 96	*n* 99½
Great Western Pwr.	6s	1949 102	*n*100	*n*102½
Great Western Pwr.	6s	1952 102	*n*100	*n*102½
HAMBURG ELEC.	7s	1935 95½	94	96
Havana Elec. R., Lt. & P	5s	1954 93	92½	93½
Holtwood Pwr.	6s	1954 103½	*n*100	*n*104½
Houston Ltg. & Pwr.	5s	1931 100½	*n* 98½	*n*101
Houston Ltg. & Pwr.	5s	1953 95	*n*90½	*n*95½
Houston Ltg. & Pwr.	5½s	1954 101½	*n* 97	*n*102½
Hydraulic Pwr.	5s	1951 101	*n* 99½	*n*102
Hydraulic Pwr.	5s	1950 101	*n*100	*n*103
IDAHO PWR.	5s	1947 97	*n* 93	*n* 97½
Ill. Elec. Pwr.	6s	1943 102½	*n* 99½	*n*103½
Ill. Pwr.	5s	1933 93½	*n* 93	*n* 95½
Ill. Pwr.	6s	1944 *k* 98	....	....
Ill. Pwr. & Lt.	5½s	1954 97½	*n* 97½	*n* 98½
Ill. Pwr. & Lt.	6s	1953 101	*n*100½	*n*102½
Ill. Pwr. & Lt.	7s	1953 103	*n* 99	*n*104
Ind. Elec.	6s	1947 98	*n* 96	*n* 99½
Ind. Gen. Serv.	5s	1948 97½	*n* 92	*n* 97½
Ind. Lighting.	4s	1958 83½	*n* 78	*n* 84
Indiana & Mich. Elec.	5s	1957 99½	*n* 97½	*n* 99½
Indiana & Mich. Elec.	5s	1955 97½	*n* 95	*n* 98
Ind. Pwr.	7½s	1941 *m*105½	*n*104	*n*106
Ind. Service.	5s	1950 92	*n* 86½	*n* 92
Ind. Service.	6s	2020 87½	*n* 73	*n* 88½
Ingersoll-Rand.	5s	1935 100	....	....
Interstate Elec.	6s	1933 95	*n* 95	*n* 99½
Interstate Pwr.	6s	1944 *k* 97½	....	....
Interstate Pwr.	7s	1934 *k*101	....	....
Interstate Pub. Serv.	6s	1948 98½	*n* 96	*n*100½
Iowa Ry. & Lt.	5s	1932 98½	*n* 97	*n* 99½
Iowa Southern Utilities.	5½s	1950 95	*n* 92½	*n* 97½
JERSEY CENT. PWR. & LT.	5½s	1945 95½	*n* 95	*n* 98
KANSAS CITY PWR. & LT.	5s	1952 *k*101½	....	....
Kansas Elec. Pwr.	6s	1937 100½	*n* 97½	*n*102
Kansas Elec. Pwr.	6s	1943 100½	*n* 97½	*n*102
Kansas Gas & Elec.	6s	1952 103	101½	103½
Kansas Gas & Elec.	6s	2022 93	*n* 86½	*n* 94½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Mont real; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Tuesday, Feb. 16. *l*Bid, low, high, Wednesday, Feb. 17. *m*Latest quotations available. *n*1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies		Bid Price Saturday Feb. 13	Low 1926	High 1926
BONDS (Continued)				
Kentucky Hydro Elec	6s	1949	100½	n 99½ n101
Kentucky Utilities	6s	1949	100½	n 97 n101½
Kings Cty. Elec. L. & P.	5s	1937	102½	102 102½
Kings Cty. Elec. L. & P.	6s	1997	123	120½ 122½
Kings County Ltg	5s	1954	100	98½ 100½
Kings County Ltg	6½s	1954	106	106 108½
Knoxville Ry. & Lt	5s	1946	95½	n 88 n 95½
LACLEDE GAS LT	5s	1934	101½	100½ 101½
Laclede Gas Lt	5½s	1953	k 99½	98 100½
Laurentian Pwr	6s	1936	100	n 96 n100½
Laurentide Pwr	5s	1946	99½	n 97 n100½
Lehigh Pwr. Sec.	6s	2026	k 95	25½ 95
Lincoln Gas & Elec	5s	1941	93	n 91 n 95½
Long Island Ltg	5s	1936	k100	....
Long Island Ltg	6s	1954	m100½	100 101½
Long Island Ltg	6s	1948	105½	n102 n105½
Los Angeles Gas & Elec	5s	1939	k100	....
Los Angeles Gas & Elec	5½s	1943	100	n 94 n 99½
Los Angeles Gas & Elec	5½s	1947	k100	....
Los Angeles Gas & Elec	5½s	1949	100	n 95½ n 99½
Los Angeles Gas & Elec	6s	1942	103½	n101½ n104½
Louisiana Pwr	6s	1944	99	n 97 n 99½
Louisville Gas & Elec	5s	1952	k 98½	....
Louisville Gas & Elec	5½s	1954	103	n 99 n103½
Lower Austrian Hydro El	6½s	1944	87½	87½ 87½
Luzerne Cty. Gas & El	5s	1948	98	n 97 n 99½
Luzerne Cty. Gas & El	7s	1944	104½	n 99½ n104½
Luzerne Cty. Gas & El	6s	1954	103½	n 99 n105
MADISON RIV. PWR	5s	1935	100½	n 99½ n101
Manila Elec.	7s	1942	102½	102 103
Manila Elec. Ry. & Ltg	5s	1953	91	89½ 91½
Manitoba Pwr	7s	1941	k105½	103½ 105½
Memphis Pwr. & Lt	5s	1948	99½	n 95 n 99½
Metropolitan Edison	6s	1952	106½	104 106½
Metropolitan Edison	5s	1953	98½	96½ 98½
Metropolitan Pwr	6s	1953	104½	102½ 104½
Michigan Lt	5s	1946	k 99½	....
Michigan No. Pwr	5s	1941	98½	n 95½ n 99½
Milwaukee El. Ry. & Lt	5s	1926	99½	99½ 99½
Milwaukee El. Ry. & Lt	4½s	1931	98½	98 99
Milwaukee El. Ry. & Lt	5s	1951	99½	98½ 99½
Milwaukee El. Ry. & Lt	5s	1961	93½	90½ 93½
Milwaukee El. Ry. & Lt	6s	1953	104½	100½ 104½
Minn. Pwr. & Lt	5s	1955	96½	n 95 n 97
Minn. Pwr. & Lt	6s	1950	105½	n101½ n105½
Miss. Power	5s	1955	93½	n 91 n 93
Miss. River Pwr	5s	1951	k 99½	....
Miss. River Pwr	7s	1935	102	n102 n104
Mo. Edison Elec	5s	1927	m100½	100½ 100½
Mobile Elec.	5s	1946	k 98½	....
Monongahela W. Pa. Pub. Service	5½s	1953	95½	n 95 n 97½
Montana Pwr	5s	1943	101½	99½ 101½
Montgomery Lt. & W.P.	5s	1943	m 93	n 86½ n 93½
Montreal Lt., Ht. & Pwr	4½s	1932	97	n 97 n 98½
Montreal Lt., Ht. & Pwr	5s	1933	99½	n 98½ n101
Montreal Pub. Serv	5s	1942	94½	n 89 n 94½
Mountain States Pwr	6s	1938	99	n96½ n100½
NASHVILLE RY. & LT.	5s	1953	97½	n 94 n 99
Nashville Ry. & Lt	5s	1958	91½	n 84 n 92
Nassau Lt. & Pwr	5s	1927	99½	n 98 n101
Nassau & Suffolk Ltg	5s	1945	90	n 82 n 91
National Elec. Power	6s	1945	93	n 92 n 97
National Pwr. & Lt	7s	1972	k103½	....
National Pub. Serv	6½s	1955	95	n 94 n 97½
Nebraska Pwr	5s	1949	99½	n 97 n100½
Nebraska Pwr	6s	2022	95	n 89½ n 97½
Nevada-Calif. Elec	6s	1946	k 99½	....
Nevada-Calif. Elec	6s	1950	99½	n 96½ n100½
New Brunswick Pwr	5s	1937	82	n 81 n 82½
New England Pwr	5s	1951	101½	n100½ n103
New Jersey Pwr. & Lt	5s	1936	97½	n 92½ n 97½
New Orleans Pub. Serv	4½s	1935	88	n 83½ n 88½
New Orleans Pub. Serv	5s	1952	k 93	....
New Orleans Pub. Serv	5s	1955	92½	90½ 92½
New Orleans Pub. Serv	6s	1949	90½	n 86½ n 93½
N.Y. & Queens El. L.&P.	5s	1930	102½	100½ 103½
N.Y. & Westchester Ltg	4s	2004	80½	n 76 n 81
N.Y. & Westchester Ltg	5s	1954	98	n 93 n98½
New York Edison	6½s	1941	115½	115½ 116½
New York Edison	5s	1944	102½	102 103½
N.Y. Gas & El. L., H.&P.	5s	1948	104½	104 105
N.Y. Gas & El. L., H.&P.	4s	1949	k 90½	....
N.Y. State Gas & Elec	5½s	1962	100½	n 96 n101½
Newport News & Hampton Ry., Gas & Elec	5s	1944	90	n 84 n 93
Niagara Falls Pwr	5s	1932	k102½	....
Niagara Falls Pwr	6s	1932	105	105 106½
Niagara Falls Pwr	6s	1950	105½	n105½ n106½
Niagara, Lock. & Ont. Pwr.	5s	1954	m 98½	n104½ n110
Niagara, Lock. & Ont. Pwr.	5s	1955	100½	99 100½
Niagara, Lock. & Ont. Pwr.	6s	1958	k100½	....
Norfolk Ry. & Lt	5s	1949	95	n 93 n 96
No. Amer. Edison	6s	1952	k103½	....
No. Amer. Edison	6½s	1948	k105	....
No. Amer. Lt. & Pwr	7s	1954	99½	n 97 n100½
North Caro. Pub. Serv	5s	1934	k 93	....
North Caro. Pub. Serv	6s	1954	95	n 91½ n 96
North Caro. Pub. Serv	6½s	1944	99	n 96 n100
North Shore Elec	5s	1940	99½	n 97½ n100
No. Calif. Pwr	5s	1948	k100	....
No. Ind. Gas & Elec	5s	1929	99	n 97 n100½
No. Ind. Gas & Elec	6s	1952	103½	n 99½ n103½
Northern N. Y. Utilities	5½s	1949	100	n 96½ n100½
No. Ohio Pwr	7s	1935	k 95½	....
No. Ohio Trac. & Lt	4s	1933	87	n 82 n 87½
No. Ohio Trac. & Lt	5s	1956	85	n 78 n 87
No. Ohio Trac. & Lt	6s	1926	99	n 98½ n100
No. Ohio Trac. & Lt	6s	1947	94	92½ 95½
No. Ontario Lt. & Pwr	6s	1931	m100	n 95½ n100½
No. States Pwr	6½s	1933	128	123 131
No. States Pwr. (notes)	6½s	1933	103½	103 104½
No. States Pwr	6s	1948	k103½	....
No. States Pwr	6s	1941	106	105½ 106½
No. States Pwr	5s	1941	k 99	....
No. Tex. Elec	5s	1940	70	n 72 n 82½
Northwestern Elec	6s	1935	102½	n101½ n102½
Northwestern Pub. Serv	6½s	1948	100	n 97½ n100½
Nova Scotia Tr. & Pwr	5s	1946	88	n 84 n 89
OHIO PWR	5s	1952	k 95	95½ 95½
Ohio Pwr	6s	1953	104½	n101 n104
Ohio Pwr	6s	2024	96½	n 88½ n 95½
Ohio Pwr	7s	1951	105½	n105½ n107½
Ohio Pub. Serv	5s	1954	93	n 87 n 93
Ohio Pub-Serv	6s	1953	100½	n 99 n101½
Ohio Pub. Serv	7½s	1946	113	112½ 113½
Ohio Pub. Serv	7s	1947	111	110½ 111½
Ohio River Edison	6s	1948	103½	102 104
Okla. Gas & Elec	5s	1950	93½	n 91½ n 95
Okla. Gas & Elec	6s	1940	k 96	....
Ontario Pwr. of Niagara Falls	5s	1943	k100	....
Ontario Transmission	5s	1945	99½	99½ 99½
Ozark Pwr. & Wtr	5s	1952	78	n 75 n 79
PACIFIC COAST PWR.	5s	1940	99½	n 98 n100
Pacific Gas & Elec	5s	1942	100	97½ 100
Pacific Gas & Elec	5s	1955	m 93½	n 94 n 95½
Pacific Gas & Elec	5½s	1952	k103½	....
Pacific Gas & Elec	6s	1941	k107	....
Pacific Lt. & Pwr	5s	1942	k101	....
Pacific Lt. & Pwr	5s	1951	100½	n 98½ n100½
Pacific Pwr. & Lt	5s	1930	k 99½	....
Pacific Pwr. & Lt	5s	1953	m 96½	....
Parr Shoals Pwr	5s	1952	97	n 92½ n 97
Paterson & Passaic G.&E.	5s	1949	100½	100 100½
Penn Central Lt. & Pwr	6s	1953	103½	n102 n104½
Penn Edison	5s	1946	98	n 93½ n 97½
Penn Elec	6½s	1954	98	n 96 n 99½
Penn. Elec	6s	1955	93	n 91½ n 95
Penn.-Ohio Edison	6s	1950	k105	98½ 106
Penn Ohio Elec	6½s	1938	107	n 99½ n106
Penn Ohio Pwr. & Lt	5½s	1954	k 99½	....
Penn Ohio Pwr. & Lt	6s	1939	97½	n 94 n 99½
Penn Pwr. & Lt	5s	1952	98½	98 99
Penn Pwr. & Lt	5s	1953	98½	98 99
Penn Pwr. & Lt	6s	1953	105	n102½ n105½
Penn Pwr. & Lt	7s	1951	106	n105½ n107
Penn Pub. Serv	5s	1952	k 97	n 93 n 96½
Penn Pub. Serv	6s	1947	104	n103 n105½
Penn Wtr. & Pwr	5s	1940	102½	n 99½ n102½
Penn Wtr. & Pwr	5½s	1953	103½	n100 n103½
Phila. Co	6s	1944	k104½	....
Phila. Co	5½s	1938	100½	98½ 100½
Phila. Co	5s	1951	98½	n 93½ n 97
Phila. Co	5s	1949	c104½	103½ 104½
Phila. Elec	5s	1966	c104½	102½ 104½
Phila. Elec	4s	1966	m 85	85 85
Phila. Elec	5s	1960	c103	102 103
Phila. Elec	6s	1941	c108½	107½ 109½
Phila. Elec	5½s	1947	c107½	106½ 107½
Phila. Elec	5½s	1953	c107½	106 107½
Portland Elec. Pwr	6s	1947	k100½	....
Portland Gen. Elec	5s	1935	100½	99½ 100½
Portland Ry., Lt. & Pwr.	5s	1942	90½	88½ 93
Portland Ry., Lt. & Pwr.	6s	1947	99½	99 100½
Portland Ry., Lt. & Pwr.	7½s	1946	107	106½ 108
Potomac Edison	6s	1949	99½	n 96 n100½
Potomac Edison	6½s	1948	103	n 99 n104
Potomac Elec. Pwr	5s	1929	j101	....
Potomac Elec. Pwr	5s	1936	j100½	....
Potomac Elec. Pwr	6s	1953	j107½	....
Potomac Elec. Pwr	7s	1941	j106½	....
Power Corp. of N. Y	6s	1942	101	n 97 n101½
Power Corp. of N. Y	6½s	1942	104½	n101½ n105½
Power Securities	6s	1949	k 77	....
Pub. Lt. & Pwr	5s	1945	71	n 64 n 79
Pub. Serv. Co. of Colo	5½s	1954	95½	n 92 n 96
Pub. Serv. Co. of Colo	6s	1953	100½	n 98 n101
Pub. Serv. Co. of Colo	7s	1933	101½	n 98½ n102½
Pub. Serv. Corp. of N.J	5s	1959	105	104½ 105
Pub. Serv. Corp. of N.J	6s	1944	k102½	....
Pub. Serv. Co. of No. Ill.	5s	1956	99	n 91 n 98
Pub. Serv. Co. of No. Ill.	5½s	1962	104½	n 96½ n102½
Pub. Serv. Co. of No. Ill.	5½s	1964	104½	n 96½ n102½
Pub. Serv. Co. of Okla	6s	1949	99	n 97½ n101
Pub. Serv. Elec. & Gas	5½s	1959	k105½	....
Pub. Serv. Elec. & Gas	5½s	1964	k104½	....
Pub. Util. Evansville, (Ind.)	6s	1929	100	n 99 n101
Puget Sound Pwr	5s	1933	99½	n 98½ n100½
Puget Sound Pwr. & Lt	5½s	1949	k 99	....
QUEBEC PWR	6s	1953	102½	n 98½ n102½
Queensborough Gas & E.	5s	1952	99½	n 96½ n100½
Queensborough Gas & E.	6s	1953	104½	n101 n105½
RHINE-WESTPHALIA ELECTRIC PWR	7s	1950	k 96	93½ 96
Rio de Janeiro Tram., Lt. & Pwr	5s	1935	94	n 85 n 94½
Robbins & Myers	7s	1952	66	60 66
Rochester Gas & Elec	5½s	1948	105½	105½ 106
Rochester Gas & Elec	7s	1946	113½	112½ 114
Rochester Ry. & Lt	5s	1954	100½	n 99 n101½
Rockford Elec	5s	1939	99½	n 98 n101
ST. MAURICE PWR	6½s	1953	108½	n107 n109
St. Paul Gas Lt	5s	1944	100½	n 98½ n101½
St. Paul Gas Lt	5½s	1954	111½	n 102½ n102½
St. Joseph Ry., Lt., H.&P.	5s	1937	93	91½ 97
Salt River Valley Wtr	6s	1938	k100	....
Salmon River Pwr	5s	1952	100½	n 98½ n101½
San Antonio Gas & Elec	5s	1949	96½	n 96 n 98½
San Antonio Pub. Serv	6s	1952	102½	101½ 102½
San Diego Cons. G.& E.	5s	1939	k100	....
San Diego Cons.G.&E.	6s	1939	101½	n 99 n103
San Joaquin Lt. & Pwr	5s	1945	99½	n 98 n100
San Joaquin Lt. & Pwr	6s	1950	103	n101 n103½
San Joaquin Lt. & Pwr	6s	1952	103	n 99½ n103½
San Joaquin Lt. & Pwr	6s	1954	101½	n 99 n101½
Sauda Falls	5s	1955	k 96	94½ 96
Savannah Elec. & Pwr	7½s	1941	k104½	....
Saxon Pub. Wks. (Germany)	7s	1945	95½	92½ 95½
Scranton Electric	5s	1937	102	n 99½ n102½
Seattle Elec	5s	1930	101	n 99½ n101
Seattle Elec	5s	1929	99½	n 99 n100½
Seattle Elec	5s	1939	93	n 90 n 93½
Seattle Ltg	5s	1949	91½	n 85½ n 93
Shawinigan Wtr. & Pwr	5s	1934	100½	n100 n101½
Shawinigan Wtr. & Pwr	5½s	1950	104	n101½ n104½
Shawinigan Wtr. & Pwr	6s	1950	105	n104½ n106½
Sheboygan Elec	5s	1946	95½	n 94 n 97
Siemens & Halske	7s	1928	k 99½	96 100
Siemens & Halske	7s	1935	k 96½	93 96½
Sierra & San Fran. Pwr	5s	1949	k 77	....
Sierra & San Fran. Pwr	6s	1949	90	n 87 n 93½
Sioux City Gas & Elec	6s	1947	102	n 99 n102½
Sioux City Gas & Elec	6s	1949	102½	n 99 n102½
So. Caro. Gas & Elec	6s	1942	82	n 87 n 93
So. Caro. Gas & Elec	6s	1932	75	n 78 n 88
Southeast Pwr & Lt	6s	2025	k104½	103½ 109
So. Cal. Edison	5s	1939	100½	n 99 n101
So. Cal. Edison	5s	1944	98	n 92½ n 97
So. Cal. Edison	5½s	1944	102½	n 98½ n102
So. Cal. Edison	6s	1943	103½	n100½ n104
So. Cal. Edison	6s	1944	k105	....
So. Cities Utilities	8s	1931	98	n 99 n102
Southern Colo. Power	6s	1947	k 99½	....
So. Ind. Gas & Elec	6s	1947	k97½	....
Southern Pwr	5s	1930	100	n 99 n101
So. Public Utilities	5s	1943	100½	n 97½ n100½
So. Sierras Pwr	6s	1936	102½	n102 n104½
So. Utilities	6s	1933	m102	n 97½ n102½
So. Wisconsin Pwr	5s	1938	91½	n 88 n 93
Southwestern Gas & E	5s	1932	96½	n 94 n 98
Southwestern Gas & E	6s	1957	98	n 89 n 98
Southwestern Lt. & Pwr.	6s	1937	98½	n 94½ n 99
Southwestern Power	6s	1944	96½	n 96 n 98
Southwestern Pwr. & Lt.	5s	1943	95	n 90 n 97
Southwestern Pwr. & Lt.	6s	2022	92½	n 88½ n 94½
Southwestern Pub. Serv	6s	1945	94	n 94 n 99
Southwestern Utilities	8s	1936	95	n 96 n102
Springfield Ry. & Lt	5s	1926	99½	n 98½ n100½
Standard Elec. of Cal	5s	1939	100	n 98½ n100½
Standard Gas & Elec	6s	1935	k 99½	....
Staten Island Edison	6½s	1953	106	n104 n107
Superior Water, Lt. & Pwr.	4s	1931	94½	n 93 n 95
Syracuse Ltg	5s	1951	100½	100½ 100½
Syracuse Ltg	5½s	1954	103½	n100½ n103½
TAMPA ELEC	5s	1933	k 99	....
Tenn. Elec. Pwr	6s	1947	k104½	....
Tenn. Pwr	5s	1962	96	n 90 n 96½
Tex. Pwr. & Lt	5s	1937	99	n 97 n 99½
Tex. Pwr. & Lt	6s	2022	94½	n 90 n 97½
Tide Water Pwr	6s	1942	99½	n 98½ n101
Tide Water Pwr	7s	1937	99½	n 97½ n101½
Toho Elec. Pwr. (Japan)	7s	1955	k 91½	....
Tokyo Elec. (Japan)	6s	1928	k 98½	....
Toledo Edison	5s	1947	99½	n 97 n100
Toledo Edison	7s	1941	k109	....
Toledo Gas, Elec. & Htg	5s	1935	98	n 97 n100½
Toledo Tr., L.&P. (notes)	5½s	1930	98½	98 99
Topeka Edison	5s	1930	99	n 97 n100
Topeka Ry. & Lt	5s	1933	94½	n 90½ n 96½
Trenton Gas & Elec	5s	1949	100½	100½ 100½
Tri-City Ry. & Lt	5s	1930	k 98½	....
Twin State Gas & Elec	5s	1953	95½	n 84 n 94½
Twin State Gas & Elec	5½s	1945	98	n 96 n 98½
Tyrol Hydro-Elec. Pwr	7½s	1955	m 96½	n 94½ n 97
UJIGAWA ELEC PWR	7s	1945	92½	n 90 n 92
Union Elec. Lt. & Pwr	5s	1932	102½	100½ 102½
Union Elec. Lt. & Pwr	5s	1933	100½	100½ 100½
Union Elec. Lt. & Pwr	5s	1954	90	n 97½ n100
Union Elec. Lt. & Pwr	5½s	1954	102½	100½ 102½
United Elec. of N.J	4s	1949	87½	n 85 n 89
United Elec. Lt. & Pwr	4½s	1929	98	n 96 n100
United Gas & Elec	6s	1945	101½	n 96 n101
United Lt. & Pwr. (notes)	5½s	1928	99½	n 98 n100
United Lt. & Pwr	5½s	1959	96	n 90½ n 97½
United Lt. & Pwr	6½s	1974	97½	n 92½ n 97½
United Lt. & Rys	5s	1932	k 96½	....
United Lt. & Rys	6s	1926	100	n100½ n101½
United Lt. & Rys	6s	1952	99½	n 95½ n100½
United Lt. & Rys	6s	1973	90½	n 87 n 92
United Pwr. & Lt	6s	1944	102½	n 99 n103
United Water, G. & E.	5s	1941	93½	n 92 n 94
Utah Lt. & Trac	5s	1944	k 88½	....
Utah Pwr. & Lt	5s	1944	k 96½	....
Utah Pwr. & Lt	6s	1944	103	n102 n104½
Utah Pwr. & Lt	6s	2022	94	n 88½ n 94½
Utica Elec. Lt. & Pwr	5s	1950	101½	100½ 101½
Utica Gas & Elec	5s	1957	101½	100½ 101½
Utica Gas & Elec	5½s	1949	104	n101 n 103½
VERMONT HYDRO-ELEC	6s	1929	100½	n 98½ n100½
Vicksburg Lt. & Trac	5s	1932	92½	n 89 n 93½
Virginian Pwr	5s	1942	95	n 88 n 96
Virginian Pwr	6½s	1954	103½	n 99 n103½
Virginia Ry. & Pwr	5s	1943	98½	97½ 99
Virginia-Western Pwr	6s	1953	101½	n100 n101½
WAGNER EL. MFG	7s	....	m100½	100½ 100½
Washington Coast Util	6s	1941	102½	n 99½ n102
Washington Ry. & Elec	4s	1951	j 81	....
Washington Ry. & Elec	6s	1933	j 101½	....
Washington Wtr. Pwr.	5s	1939	102	101½ 102
West Penn Pwr	5s	1963	k100½	....
West Penn Pwr	5s	1946	100½	99½ 101
West Penn Pwr	5½s	1953	105½	104½ 106
West Penn Pwr	7s	1946	k106½	....
W. Va. Lt., Ht. & Pwr	6s	1929	102½	n 95 n101½
West Virginia Utilities	6s	1935	96½	n 91 n 98
W. Va. Water & Elec	6½s	1942	102½	n100 n104
Westchester Ltg	5s	1950	102½	102½ 103½
Western Elec	5s	1944	100½	100½ 100½
Western N. Y. Utilities	5s	1946	97	n 90½ n 97½
Western Pwr	6½s	1954	100½	n 97 n101½
Western Pub. Service	6s	1950	98½	n 96 n 98½
West States Gas & Elec	5s	1941	98½	n 95 n 99½
West States G.&E. (notes)	6s	1937	94½	n 94 n 97
West States Gas & Elec	6s	1947	k 99	....
West United Gas & El	5s	1950	100	n 97 n101
West United Gas & El	6s	1950	102	n100 n102½
Westphalia Un. Elec. Pwr	6½s	1950	m 87½	n 87½ n 97½
Westinghouse El. & Mfg.	7s	1931	k105½	....
Wheeling Elec	5s	1941	97½	n 96 n 99
Wichita R. R. & Lt	5s	1932	84	n 83 n 88
Winnipeg Elec	6s	1954	96½	n 94 n 97½
Wisconsin Elec. Pwr	5s	1954	99	n 93½ n 99½
Wisconsin Gas & Elec	5s	1952	99½	n 97 n100½
Wis.-Minn. Lt. & Pwr	5s	1944	k 95	....
Wisconsin Pwr., Lt. & Ht	5s	1946	92	n 87 n 93
Wisconsin Pub. Service	6s	1952	101½	n 99 n102½
Wis. Ry., Lt. & Pwr	5s	1933	92½	n 87½ n 93½
Wis. River Pwr	5s	1941	93	n 88 n 92½
Wolverine Pwr	7s	1943	100	n 99 n101½
YADKIN RIVER PR.	5s	1941	k 99½	....
Yarmouth Lt. & Pwr	5s	1937	83	n 82 n 87
Yarmouth Lt. & Pwr	8s	1951	99	n 97 n102

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Tuesday, Feb. 16. lBid, low, high, Wednesday, Feb. 17. mLatest quotations available. n1925.

Manufacturing and Markets

Cut Distribution Costs, Says M. C. Turpin

Addressing the Metropolitan Electric League of Boston on Feb. 12, M. C. Turpin, special representative of the merchandising department of the Westinghouse Electric & Manufacturing Company, declared that "the service which the public demands of the manufacturer and merchant is what keeps up the high cost of living. When one takes into consideration the number of costs that our commodities assume in getting to the ultimate consumer, such as railroad charges, handling, advertising, delivery and overhead charges of the merchant, it is evident that we are living in an age of luxury—and this is the spirit of the country," said the speaker.

"Cost of distribution alone, an item of special interest to us of the electrical industry, is a factor of grave concern. Distribution costs for furniture are reckoned at seven and one-half times the cost of manufacture; of watches, six and one-half; of farm products, five times, and of electrical equipment, three and one-half times, a figure low in comparison with others quoted, but not low enough. What, then, is the solution? First should be mentioned the great saving to the consumer which will result in standardization of our products. Much has been accomplished to this end, but more must follow. Second is more efficient and better-planned advertising, and this means more attention to national advertising. Third, we must consider the matter of selling costs, which involves careful consideration of selling ability, of high-grade salesmen and local advertising and, in addition, the expansion of interest in electrical ideas."

Individual Versus Composite Credit Experience

It is never safe for a company to extend credit to a customer because its individual experience with the customer is satisfactory if the composite experience of all creditors with the buyer, as reflected by a credit association, is unsatisfactory. In a specific example bearing on this point it was found that a company had been and was still extending credit to a firm which had been very prompt in discounting its bills with that company. The creditor, therefore, thought that it had a satisfactory and even desirable customer, despite confidential reports received from a credit association of which the creditor was a member indicating that several other members had accounts outstanding against the customer for long periods.

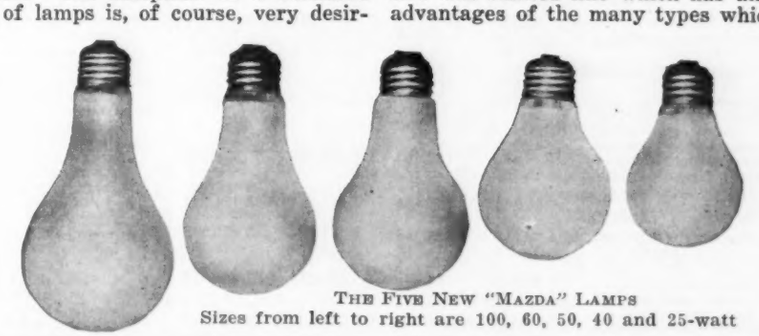
In explaining the apparent discrepancy between this individual company's experience and the composite experience, F. P. Vose, secretary of the National Electrical Credit Association, pointed out that many firms which have bills outstanding against them make a practice of maintaining good credit relations with at least one seller, and usually a big one, so they can use that company as a reference for obtaining other credit. Furthermore, if this customer continues to pay bills to one company out of proceeds that rightfully belong to all creditors, some or all of the neglected creditors will eventually bring suit or force the debtor into bankruptcy. If this action occurs after goods have been sold to the customer in question and before payment is received, the creditor who was continuing business relationships on the basis of individual experience as opposed to composite credit standing will suddenly realize the folly of this practice. Eventually this situation is sure to develop in such a case.

In the particular instance cited the company which had been supplying goods and had been receiving prompt payment could not be convinced about the true situation, and so it continued to deliver goods and receive prompt payment. Suddenly, however, the receivership proceedings, prophesied by the secretary of the credit association, were instituted, and the company which relied entirely on its own experience was left "holding the bag," the burden of which was not lightened much by liquidation.

The New Lamp Standardization

Five Lamps to Replace Forty-five Previously Employed for General Lighting Service—Coil Filament Used—Better Lamps at Lower Costs Are Assured

WITH the announcements made a few months ago concerning the new 25-watt inside-frosted lamp, which was placed on the market July 1, there came an additional announcement that this was the first lamp of a new standard line of "Mazda" lamps. The second lamp of this new line, the 100-watt inside-frosted lamp, was placed on the market on Nov. 1, and the complete line was announced as available this month. The complete line is shown in the illustration. The inception of a standard line of lamps is, of course, very desirable from the standpoint of standardization, for almost without exception in every industry where a definite standardization program has existed the manufacturers as well as the consumers have reaped many benefits from it.



THE FIVE NEW "MAZDA" LAMPS
Sizes from left to right are 100, 60, 50, 40 and 25-watt

The lamp industry has for years been directing its efforts to the simplification and standardization both of its line of lamps and its processes and equipment used in making them. While lamp voltages and lamp bases have been reduced in variety, there still remains considerable room for the advancement of a more complete standardization program. The present program for this new line of lamps affects particularly the assortment of lamps of 100 watts and smaller, which are used for general lighting service.

A careful study of requirements to be met in service has shown that the 45 different lamps of several sizes, types and finishes (not counting the three usual voltages of 110, 115 and 120) which existed in the field can be satisfactorily replaced by a single series of but one uniform type and finish. The desired type standardization can be best brought about, not by the substitution of one type of lamp for another, but rather by the introduction of an entirely new and limited line which has all the advantages of the many types which it will replace. Fortunately recent progress in the art of lamp making has made it possible to incorporate in such a new line certain desirable features not present in the older line of lamps.

The frosting of the bulbs on the inside, which forms the principal feature of the new line of lamps, has aroused considerable interest. The advantages of inside frosting have been realized for more than a score of years, but all attempts at inside frosting had heretofore been unsuccessful as the bulbs were left so weak that they could hardly be handled without breakage. A process, however, has been developed which restores the strength of the frosted bulb to its original value. This process may be readily explained by means of a simple analogy. It happens that the

etching of the inside surfaces of a lamp to produce a frost causes minute cracks or splits to form in the glass structure. These imperfections are elongated by very minor shocks or jars just as the cracks in a plate glass window are easily increased in length by small movements of the glass. In the latter case, however, the crack may effectively be prevented from spreading if a hole is drilled at its extremity. By this means the remainder of the window is kept intact. Similarly, the frosted glass surface can be treated to produce a similar effect in the sense that it keeps the cracks from spreading and the frost does not then impair the sturdiness of the lamp.

The inside frost of the new lamp diffuses the light, reducing the glare of the incandescent filament without at the same time absorbing more than 1 or 2 per cent of the light that would be obtained from a lamp with a transparent clear-glass bulb. Moreover, the absorption of the inside-frosted lamp does not increase so rapidly during the life of the lamp as does that of an outside-frosted or sprayed lamp, as may be seen from the table above.

The increased absorption after burning is caused by a slight deposit given off by the filament which settles on the inside of the lamp bulb after the lamp has burned for some time. Even clear lamps lose some of their candlepower with age because of this film. However, the loss in efficiency of the inside-frosted lamp from this cause is about the same as that of a clear lamp, while with the outside-frosted lamp it is much greater inasmuch as the internal reflections of the outside-frosted lamp are more numerous and some of the light rays having to pass through this film several times are absorbed to a large extent.

APPROXIMATE ABSORPTION IN PER CENT OF LAMPS WITH CLEAR BULBS

	Initially, Per Cent	After Burning 800 Hours, Per Cent
Inside frost	1– 2	1– 5
Sand frost (outside)	5–10	10–20
Spray frost (outside)	5–10	10–20
White "Mazda" (sprayed)	10–15	15–30
Opal glass	10–15	15–30

Another advantage of the new lamps over the clear lamp is that the former give more light in a downward direction than the corresponding low-wattage sizes in which straight filaments were used. This is of importance in general lighting service, since, as a rule, the existing fixtures for lamps of low wattage are designed to shield the light source rather than to control or redirect the light. Because of the better distribution of light, considerable improvement will be made in general lighting by the use of the new inside-frosted lamps.

The frosting of any lamp, of course, decreases its brilliance and therefore its tendency to cause annoyance from glare. In fact, in the case of the 25-watt lamp the inside frost lowers the maximum intrinsic brilliancy of the light source from 2,000 cp. per square inch, the brightness of a bare filament, down to approximately 25 cp. per square inch, with a scarcely measurable loss in efficiency. Furthermore, the brightest part of the bulb appears in line with the filament and the bulb brightness decreases in intensity toward the edge of the lamp, thus making the contrast between the lamp and its darker background less noticeable. It is desirable from the standpoint of glare that excessively sharp contrasts such as exist between the bright edge of an outside-frosted lamp and its darker background be relieved by a

Value of Electrical Exports for December, 1925, and for Entire Year, Compared with 1924

(Issued by Bureau of Foreign and Domestic Commerce)

Articles	December, 1924	December, 1925	Year 1924	Year 1925
Generators:				
Direct-current:				
Under 500 kw	$62,008	$116,604	$1,067,206	$847,697
500 kw. and over	5,345	4,900	849,777	427,857
Alternating-current:				
Under 2,000 kva	15,317	42,998	169,156	324,325
2,000 kva. and over	18,500	398,002	1,157,167	1,879,774
Steam turbine generator sets	*	69,221	74,537	564,779
Accessories and parts for motors	58,328	130,499	1,269,927	1,089,265
Self-contained lighting outfits	53,864	108,105	780,124	1,075,981
Batteries:				
Flashlight batteries	82,287	162,777	893,368	1,213,766
Other primary batteries	68,180	113,100	817,604	1,203,966
Storage batteries	233,151	284,667	2,882,847	2,681,288
Transforming or converting apparatus:				
Power transformers	119,140	291,044	3,286,161	2,175,206
Other transformers	85,954	90,149	2,368,052	1,315,469
Rectifiers, double-current and motor generators, dynamotors, synchronous and other converters	125,696	122,164	1,156,636	966,383
Transmission and distribution apparatus:				
Switchboard panels, except telephone	66,241	108,402	2,163,364	2,304,742
Switches and circuit breakers over 10 amp.	80,519	525,522	2,245,341	2,423,838
Fuses and fuse blocks	20,662	38,748	282,142	342,831
Watt-hour and other measuring meters	28,823	18,692	623,889	447,417
Volt, watt and ampere meters, and other recording, indicating and testing apparatus	98,826	210,963	1,367,063	1,695,906
Lightning arresters, choke coils, reactors and other protective devices	45,038	79,624	920,313	707,299
Motors, starters and controllers:				
Motors, under 1 hp	101,815	235,624	1,687,170	2,101,825
Stationary motors:				
1 to 200 hp	111,287	311,370	2,392,436	2,472,418
Over 200 hp	14,344	43,109	575,562	604,022
Railway motors	31,949	4,302	1,328,453	807,537
Electric locomotives:				
Railway	10,695	107,000	1,923,113	481,666
Mining and industrial	32,160	19,786	319,927	330,655
Starting and controlling equipment:				
For industrial motors	48,798	160,965	1,429,054	1,159,011
For electric railway and vehicle motors	5,018	22,079	106,885	278,432
Accessories and parts for Motors	103,700	194,544	1,998,425	2,039,607
Electric fans	28,598	45,317	1,028,018	916,553
Electric lamps:				
Metal filament	51,547	109,134	1,069,558	1,250,357
Other electric lamps	35,765	20,711	364,553	243,739
Flashlights	84,023	185,613	776,330	1,342,225
Searchlights and projectors	35,159	42,524	380,679	561,557
Motor-driven household devices	$63,384	$108,485	$887,787	$1,205,583
Domestic heating and cooking devices	98,324	138,132	1,104,086	1,339,799
Industrial electric furnaces and ovens	23,934	33,860	239,709	252,324
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc	78,401	145,302	1,058,431	1,414,721
Signal and communication devices:				
Radio apparatus	1,080,168	967,222	6,030,914	9,903,787
Telegraph apparatus	28,365	25,460	515,620	497,231
Telephone apparatus:				
Magneto telephones	10,906	12,214	182,886	124,575
Other telephones	28,342	30,468	542,786	497,765
Telephone switchboards	1,389	33,060	1,160,751	799,054
Other telephone equipment	178,884	134,334	2,096,371	2,298,018
Railway signals, switches and attachments	54,862	64,455	964,001	803,446
Bells, buzzers, annunciators and alarms	7,460	12,162	148,738	171,017
Other electric apparatus:				
Spark plugs, magnetos and other ignition apparatus	139,328	209,362	1,911,117	2,708,142
Insulating materials	112,772	158,505	1,536,182	1,544,911
Metal conduit, outlet and switchboxes	42,321	64,120	573,568	796,503
Sockets, receptacles and lighting switches	85,530	168,817	1,278,276	1,595,297
Electric lighting fixtures (interior and street)	74,366	147,422	754,578	1,313,868
Other wiring supplies and line material	51,944	83,853	1,149,480	1,131,852
Other electrical apparatus	638,115	575,627	7,937,616	6,882,648
Globes and shades for lighting fixtures	31,734	46,881	400,791	494,947
Electrical glassware except for lighting	9,161	17,451	241,558	269,962
Electrical porcelain	160,079	*	1,767,323	*
Electrical porcelain for less than 6,600 volts	†	89,637	†	949,785
For 6,600 volts and over	†	61,274	†	702,417
Carbons, carbon brushes and electrodes	178,324	*	2,978,875	*
Electrodes for furnaces	†	148,431	†	1,213,754
Other carbon products	†	68,505	†	2,000,580
Insulated wire and cable (iron and steel)	24,578	9,904	397,804	268,155
Other manufacturers of aluminum	52,377	110,680	870,655	866,181
Copper, bare wire	87,548	183,104	1,701,656	2,094,108
Copper, insulated wire and cable	259,799	541,616	3,895,763	4,900,264
Total electrical machinery and apparatus and supplies	$5,565,132	$8,808,602	$82,082,159	$87,318,087

* Discontinued beginning Jan. 1, 1925.
† Not separately stated prior to Jan. 1, 1925.

VALUE OF CONTRACTS LET IN THE UNITED STATES AND CANADA, JANUARY, 1926

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States	Canada
Waterworks	.....	$211,000	$405,000	$1,265,000	$1,432,000	$34,000	$3,347,000	.....
Sewers	.....	474,000	392,000	3,758,000	257,000	3,607,000	8,488,000	$298,000
Bridges	.....	368,000	1,779,000	649,000	1,235,000	1,438,000	5,469,000	500,000
Excavation, drainage, etc	.....	10,000	1,107,000	100,000	451,000	92,000	1,760,000	.....
Streets and roads	$324,000	5,044,000	3,015,000	3,560,000	5,477,000	2,569,000	19,989,000	144,000
Industrial building	595,000	21,544,000	4,432,000	5,672,000	1,195,000	1,881,000	35,319,000	1,590,00
Commercial building	6,532,000	34,260,000	11,886,000	25,434,000	9,186,000	9,262,000	96,560,000	4,234,000
Federal government	21,000	1,053,000	999,000	6,000	180,000	187,000	2,446,000	.....
Unclassified	500,000	8,121,000	840,000	457,000	6,408,000	943,000	17,269,000	613,000
January, 1926	$7,972,000	$71,085,000	$24,855,000	$40,901,000	$25,821,000	$20,013,000	$190,647,000	$7,384,000
December, 1925	11,699,000	101,006,000	23,811,000	51,932,000	25,602,000	43,869,000	246,919,000	1,232,000
January, 1925	12,948,000	51,863,000	15,801,000	25,922,000	33,398,000	31,167,000	171,099,000	4,861,000

gradual shading of brightness such as is obtained with inside-frosted lamps.

The inside-frosted lamp also has a particularly desirable ability to blend itself into its surroundings, reflecting some of the color of any background with which it is in close proximity. The inside frost absorbs light falling on the outside of the bulb just as an outside-frosted bulb absorbs light coming from within, and this accounts both for the difference in appearance and for the difference in the amount of light which is absorbed from the filament. This quality allows the lamp to harmonize, for example, with the color of decorative shades.

In addition to the inside frost of the new standard line of lamps, a general characteristic bulb shape has been adopted for the various lamps in the new line. Inasmuch as the bulbs for different sizes of lamps carry identical bases, they must come down to the same neck diameter. They cannot have exactly the same shape throughout the entire line, but they are so designed that there is a gradual and consistent change from step to step which preserves the dominant characteristics of the new design throughout. It is interesting to note that the new bulb shape approaches more nearly that used by Edison for his early lamps than any we have employed in recent years. It is believed that the shape of the new line of lamps will prove very popular with the public and that they will readily replace straight-side, pear-shape and round-bulb lamps now in service.

New Carton Used with New Lamps

The new line of lamps possesses another distinctive feature in that they will be shipped in a new carton of special design. The individual lamp carton is so constructed that the lamp base is readily accessible for testing purposes and the bottom of the bulb, on which are stamped the wattage and voltage, is visible for easy identification whether the lamp is lighted or unlighted. The lamp is easily removed from the carton or readily replaced. Because of the cushioning effect of the holding flaps of the carton it is not necessary to use corrugated paper. The new carton, it is believed, will afford greater opportunities for display by the dealer.

Another feature of the new standard line of lamps is the use of the coiled filament in every size of lamp. The coil-filament construction is particularly able to withstand shocks and sudden jars. In fact, it was for this reason that this type of filament construction was chosen for the old mill-type lamps. If this new standard line of relatively few lamps can successfully replace the forty-five lamps now covering the same field, better lamps at lower costs are assured and the lamp consumer will directly benefit from the elimination of unnecessary combinations at present in use.

January Construction Contracts Reach Record

The month of January established a record for midwinter construction not reached in any corresponding period during the past fourteen years. The gain was in actual volume as well as in money value of contracts awarded. The actual volume of construction in January (not the mere money value of the contracts let) is 198 per cent of the volume of construction for 1913. The *Engineering News-Record* reports the value of contracts let during January, 1926, as shown in the accompanying table, taking the following minimum cost in each class: Waterworks and excavations, $15,000; other public works, $25,000; industrial buildings, $40,000, and commercial buildings, $150,000.

While January contracts showed a seasonal decline from the total of the month preceding, there was a substantial increase in lettings for waterworks, sewers, private excavating projects, streets and roads, and industrial buildings. The seasonal slow-down was particularly marked in Delaware, Virginia, West Virginia, Minnesota, Arkansas, Montana, Colorado, Utah and Nevada. Notable activity, however, was shown in eighteen of the states, namely, New Hampshire, Connecticut, Maryland, Georgia, Florida, Alabama, Kentucky, Tennessee, Ohio, Michigan, Iowa, South Dakota, Kansas, Texas, Wyoming, New Mexico, Idaho and Oregon.

Judging from projects in the proposed stage as late as Jan. 31, 1926 (88 per cent of which will have been awarded by April 30), there is a definite upward trend in construction of sewers in the Midwestern and Pacific Coast States, bridges in the Far West, streets and roads in the South, the last mentioned class together with industrial buildings in the Middle Atlantic section and the West, and commercial buildings in New England.

Business Conditions

SALES are in good volume in the industry, and, as a big manufacturer expressed conditions, buying is on a large scale. The bulk of the orders are coming from industrial plants and a steady stream of small orders are being received by manufacturers, who are confident that the demand will continue. Sales in January and February are very good, according to a large company. The present wave of industrial buying is classified as the biggest in the history of the industry. Central-station companies are purchasing general supplies in good volume but are not placing any large orders.

The volume of wire sales is reported as excellent, paper cable has been in demand and rubber-covered wire is being purchased in large volume. Manufacturers are keenly competitive, and prices of No. 14 wire have been reduced to the lowest figure at any time in two years, despite the much higher prices of raw materials. The United States Steel Corporation has reported a reduction of 150,625 tons in the volume of unfilled orders on Jan. 31. Forward orders on that date amounted to 4,882,739 tons. However, conditions are considered favorable owing to the prevalence of buying for immediate consumption and the high rate of shipments during the month.

In New England motor sales are steady and the demand is encouraging. A number of plant extensions are being planned for eastern Massachusetts, and central-station companies are buying equipment in good volume. Industrial conditions are promising, a demand for variable-speed motors and special types of large capacities being in evidence from central Massachusetts. Utility companies are comparatively inactive in the New York district, but industrial buying is in good volume and gives indication of continuing on a large scale. Large contracts for street and rapid-transit railway equipment aggregating several million dollars are expected to be placed within the next month. In the Southeast business is in good shape and building construction is expected to continue on a normal basis, although buyers are conservative as to future commitments. Industrial activity is quite noticeable in the Middle West, and greater plans are being consummated by manufacturers in that terri-

tory. On the Pacific Coast an excellent demand for average-sized motors and control devices is noted, and many orders for substation transformers in sizes from 500 kva. to 1,000 kva. are reported. Railroads and power companies are buying equipment, and a lumber company is expected to place a large order for motors in a few days.

Non-Ferrous Metal Market Dull—Prices Sag

NONE of the non-ferrous metals has been in very good demand. The unsettled stock market is held to be the principal reason, for business conditions continue excellent, and the settlement of the anthracite strike, the only important labor disaffection in the country, was certainly not a bearish factor. Foreign markets have fluctuated but little. Sales of copper have been in much less volume than a week ago, when an excellent business was done. In fact, producers have been so well sold up that there has been little temptation to cut prices and virtually all interests have quoted the market at 14⅜ cents, delivered, being content to make only occasional sales at these levels. One or two interests which make it a practice to market their current intake regularly shaded prices a little, doing business in Connecticut as low as 14.30 cents, delivered, and yesterday and today, following the slight decline in London, offers of good tonnages have been made for either prompt or forward shipment at 14¼ cents, without arousing any great enthusiasm among the purchasing agents. Even 14.20 cents has been named for deliveries close to New York. The brass companies report their businesses even better than last year.

NEW YORK METAL MARKET PRICES

	Feb. 10, 1926 Cents per Pound	Feb. 17, 1926 Cents per Pound
Copper, electrolytic	14.35	14.275
Lead, Am. S. & R. price	9¼	9.15
Antimony	22	21¾
Nickel, ingot	35	35
Zinc, spot	8.175	7.90
Tin, Straits	64¼	64¼
Aluminum, 99 per cent	28	28

Base copper price Feb. 17, 1926, 16 cents

The American Smelting & Refining Company reduced its contract price for New York lead to 9.15 cents on Feb. 11. This move was not unexpected in view of the decline in the London market to less than the level at which foreign bullion lead could be profitably imported. Buying has been adversely affected by the decline, as consumers feel that the trend is likely to continue downward. The zinc market has been particularly quiet all week. Monday was the only day of the week on which much tin was sold, and much of that was for the account of London houses rather than to consumers.

Business Good in Southeast—Building to Continue Normal

CONTINUATION of present building activities in the Southeast for the duration of the year are predicted in a statement issued by M. A. Oberlander, wiring supply sales manager of the Graybar Electric Company. Mr. Oberlander has just returned from a two weeks' business trip through Southern territory, where he visited the cities of Richmond, Atlanta, Tampa, Jacksonville, Miami and Savannah. Mr. Oberlander believes that building activities will continue on a normal basis. Business in general in the South appears in good shape, he said, although the people are becoming a little more conservative from the standpoint of future commitments. Mr. Oberlander does not look for any let-up in activities, however, until probably the first of next year.

Industrial Plants Show Activity in Middle West

INDUSTRIAL activity is quite noticeable in the Middle West, and greater plans are being consummated by manufacturers in this territory. The volume of business is entirely satisfactory and better business conditions are expected. Reports from the Illinois Department of Labor indicate a well-defined tendency toward an increase in factory operation. Many new manufacturers are starting operations in the Middle West and are centering their activities in the Chicago district. An interesting report is that the Union Tank Car Company is moving its general office to Chicago. Car loadings are somewhat ahead of the same period last year, indicating better business. Building activity continues favorable, with several large projects planned in Chicago.

Motors and Transformers in Demand on the Pacific Coast

AN EXCELLENT demand for average-sized motors and control devices is noted on the Pacific Coast. Sales during January are said to be 15 per cent greater than normal. Many orders for substation transformers in sizes from 500 kva. to 1,000 kva. were placed, one manufacturer recording a sale of about 25 such units. In the territory as a whole contracting business is proportionately quieter than other classes of electrical business, such as from power companies, railroads and especially from manufacturing industries. Power-company orders have included 25,000 guy clamps, 35,000 ft. of ⅜-in. high-strength strand, one carload insulators, one carload of 12-ft., 12-in. pole stubs and 200 poles 30 ft. and 35 ft. long. Present inquiries cover guy anchors, line construction tools and strain insulators. Railroad companies have placed several good orders for maintenance material, and miscellaneous orders include wiring material for export. Several inquiries from industrial plants cover wire and cable.

An order for about $30,000 worth of motors is expected to be placed by a lumber company in about ten days. During the next three months the city of Seattle will purchase substation equipment, including a 2,000-kw. mercury rectifier, oil switches, voltage regulators, etc. Plans formulated by the city will require late in the summer the purchase of a 30,000-kw. bank of transformers, a 15,000-kva. condenser and other equipment amounting to about $250,000. The city of Wenatchee is taking bids to March 1 for nine motors and pumps, switchboard and accessories for its 12,000,000-gal. filtration plant.

Power Equipment Continues in Good Demand in New England

SMALL motor sales in the New England district are steady and the demand is very encouraging. A prominent manufacturer reports difficulty in filling orders for the popular sizes. Central-station companies are buying equipment in good volume, and a number of plant extensions are being planned for eastern Massachusetts, one of which calls for the installation of a 10,000-kw. turbo-generator. Orders for circuit breakers and switch apparatus are reported by one manufacturer to be very active, and many negotiations are pending for such material for use in Southern localities. To take care of the increasing business in this line a large company states that it has become necessary to institute overtime work. In central Massachusetts industrial conditions are very promising and a demand for variable-speed motors and special types of large capacities is recorded.

Much encouragement in the introduction of both oil burners and electric refrigerators is accorded in Vermont and New Hampshire, according to the report of a manufacturer who notes increasing interest and refers to a number of recent sales of these commodities. Electric street-lighting work is active and the demand for industrial-lighting equipment is gaining. Layouts for new industrial-lighting installations made in this district for the past year and for this year to date, according to the report of the N.E.L.A. committee, number 1,000. Reflector sales are in good volume and construction supplies, while somewhat off in sales volume, are showing a fair trend.

Utilities Inactive but Industrial Buying Good in New York

A PERIOD of comparative inactivity is being experienced in the New York district as regards buying by central-station companies. Sales to public utility companies are small and infrequent, and the volume of inquiries received from this source in the last ten days is showing a marked decrease. Orders from central-station companies for materials for which estimates and quotations were requested during January have not yet materialized, although manufacturers are hopeful that activity in this class of business will develop in the near future. Sales of motors for industrial purposes continue steady, but manufacturers of control apparatus report that this business is not being favorably reflected in the demand for their products. A large manufacturer states that his sales during January and February were very good, industrial-plant buying, representing a large part of the volume. Indications are that such buying will continue on a large scale. Large contracts for street and rapid transit railway equipment aggregating several million dollars are expected to be placed within the next month.

Activities of the Trade

New England Gathers Fruits of Industrial Lighting Drive

That New England is responding to the energetic measures put forward by the N. E. L. A. industrial lighting committee, headed by Julius Daniels, illuminating engineer, Boston Edison Company, is evident by a recent report covering the activities in that district. Twenty-four thousand letters and 8,000 broadsides have been sent to prospects. Four thousand definite requests for better-lighting recommendations have resulted. From these approaches over 8,000 reflectors have been sold and about 1,000 designs for better illumination have been supplied to applicants.

Electric Refrigerator Merger Becomes Effective

The consolidation of the Kelvinator, Nizer and Grand Rapids Refrigerator corporations into the Electric Refrigeration Corporation has been announced as becoming effective. Ninety per cent of the stock of Kelvinator, 80 per cent of the stock of Nizer and all the securities of the Grand Rapids company have been deposited under the plan.

The three companies will have a capacity in excess of 500 refrigerators per day, based on normal-sized units, and 1,000 ordinary ice boxes per day. The capitalization of the corporation consists of $3,000,000 ten-year 6 per cent convertible gold notes and 571,250 shares of no-par-value capital stock.

Naugle Pole & Tie Company Announces New Pole Yard

A new pole yard has been opened at Minneapolis by the Naugle Pole & Tie Company, 59 East Madison Street, Chicago. At this new plant access will be had to nine trunk-line railroads. This yard will have elevated skids, long distance rollways, newly designed butt-treating plant, Pentrex puncturing machine, traveling cranes, etc. While it will serve primarily the surrounding territory, it will also supplement the service from the company's other yards at Chicago, Spokane, Vancouver, B. C., Green Bay, Wis., Sand Point, Idaho, and Pinconning, Mich.

Century Electric to Distribute Stock Bonus to Employees

The Century Electric Company, 1827 Pine Street, St. Louis, manufacturer of alternating-current motors and fans, has arranged to distribute as a bonus from 1925 earnings $190,000 in common stock of the company at $120 per share to those of its 3,000 employees who were connected with the company during the entire year 1925 and are still with the company on March 15, 1926. This means that such as are entitled to participate will receive at least 7 per cent of the respective salaries or earnings. A large percentage of the employees of the company are said to be stockholders, the company having always encouraged their investing in its stock.

The Dudlo Manufacturing Company, Wall Street, Fort Wayne, Ind., manufacturer of magnet wire and magnet-wire products, has completed plans and will proceed with the immediate erection of a one-story addition to its plant, to be 140 ft. x 310 ft., estimated to cost $100,000, with equipment.

The Century Electric Company, St. Louis, manufacturer of alternating-current motors and fans, it is understood, has concluded negotiations for 8 acres on Forest Park Boulevard, east of Vandeventer Avenue, in St. Louis.

The Electrical Engineers' Equipment Company, 710 West Madison Street, Chicago, has plans under way for a new plant at Melrose Park, near Chicago, consisting of two one-story structures, 275 ft. x 280 ft. and 40 ft. x 70 ft., estimated to cost about $100,000, with equipment. Stone & Webster, Inc., 38 South Dearborn Street, is the engineer and contractor.

The Moloney Electric Company, St. Louis, transformer manufacturer, recently acquired by the American Brown Boveri Electric Corporation, has purchased approximately 10 acres of ground fronting 345 ft. on Bircher Street near Union Boulevard and adjoining the Green Foundry Company's property and the Terminal Railway Company. It is said that approximately $750,000 will be expended in erecting a modern manufacturing building. With the installation of machinery in the new building, the company plans to expend about $2,000,000 to increase its manufacturing facilities.

The Chicago Fuse Manufacturing Company, Laflin and Fifteenth Streets, Chicago, announces that at a meeting of the board of directors held on Feb. 15 A. E. Tregenza, who has been assistant to the president, was appointed vice-president in charge of sales. Mr. Tregenza before coming to the Chicago Fuse Manufacturing Company in 1924 was general sales manager of the Economy Fuse & Manufacturing Company for twelve years.

The Bridgeport Brass Company, Bridgeport, Conn., announces that Herman Steinkraus has been appointed representative in the Cleveland territory and is in charge of the company's Cleveland warehouse service as well as sales.

The General Electric Company has acquired additional property in the vicinity of its plant on Elmwood Avenue, Philadelphia, comprising tracts on Sixty-seventh and Sixty-eighth Streets, to be used for expansion. Plans are being arranged for the early erection of a new six-story-and-basement unit, to be known as Unit No. 10, reported to cost about $500,000. The company also has completed plans for a one-story addition to its plant at Fort Wayne, Ind., to be 80 ft. x 120 ft. and to be used largely for foundry service.

New Equipment Available

Double-Retort Stoker

A double-retort stoker for the medium-size boiler of 300 hp. and larger, where multiple-retort, rear-cleaning stokers are normally adaptable but cannot be installed for lack of sufficient space or other conditions, has been developed by the Detroit Stoker Company, Detroit. The normal speed of the coal-feeding mechanism is greatly reduced in this stoker, the slow movement of fuel insuring better ignition, complete combustion and high capacities. With this stoker the ashes can be removed at the front of the boiler directly on the boiler-room floor, and the bottom of the ash pits can often be placed at the level of the boiler-room floor.

Extending from the sides of the retorts are heavy grates inclined downward toward the side walls. At the end of these grates are placed the dumping sections. A central air chamber is provided below the retorts, and by means of a damper the amount of air entering the air chamber is regulated. The dump plates are of the grate-bar type of construction with air ports. A damper is provided between each ash pit and the air chamber so that air under slight pressure can be admitted to the dump plates to burn out combustible in the ash completely before dumping.

Traffic Signal

A new flashing beacon designed to warn motorists of dead-ended streets, heavy traffic intersections and safety zones for street-car passengers has been developed by the Westinghouse Electric & Manufacturing Company. The beacon embodies the mercury contact flasher recently developed by the company. In this new traffic-warning beacon a white light, which burns steadily, is used for the general illumination of a small area of the street surrounding the standard.

The source of this white light is not visible to the approaching motorist, inasmuch as the light beam is reflected downward from the reflector, the lamp being concentric with the axis of the supporting standard. When the beacon is mounted at a height of 6 ft. this downward beam illuminates an area on the ground approximately 20 ft. in diameter. Mounted above the reflector for this auxiliary light is a ruby bowl-type refractor. A lamp properly positioned in this refractor is connected to the mercury contact flasher in the base of the standard and is intermittently flashed at intervals of about one second. The beacon is mounted on an ornamental cast-iron post, which is painted with white or aluminum-bronze paint.

New Trade Literature

UNIT FLASHER.—Bulletin No. 43 issued by the Reynolds Electric Company, 2650 West Congress Street, Chicago, describes the "Reco" unit flasher, a motor-driven flasher in one unit. Attention is also called to the "Reco" type "L" variable traffic control and the "Reco" color hoods for electric sign lamps.

TRAFFIC CONTROLLERS AND SIGN FLASHERS.—James H. Betts, Inc., 1391 Sedgwick Avenue, New York City, is distributing bulletin No. 101, describing its various types of traffic controllers, sign flashers, both motor and motorless, color caps, etc.

ELECTRIC IRONER.—The Savage Arms Corporation, Utica, N. Y., is distributing a poster describing and illustrating the Savage all-electric ironer with the fore-arm type-writer touch control.

AUTOMATIC SWITCHING EQUIPMENT.—"Automatic Switching Equipment" is the title of leaflet GEA-163 issued by the General Electric Company, Schenectady, N. Y., which explains the use of numbers based on a system that has been standardized by the Electric Power Club and adopted by the General Electric Company.

BALL-BEARING ELECTRIC CHAIN HOISTS.—The Yale & Towne Manufacturing Company, Stamford, Conn., is distributing a folder describing the Yale electric ball-bearing chain-hoist model 20-B, manufactured for both manual control and push-button control.

PAINTS, ENAMELS, VARNISHES AND SPECIALTIES.—Catalog A issued by the Eclipse Paint & Manufacturing Company, Cleveland, describes its paints, enamels, varnishes and protective coatings designed expressly for the oil, gas and electric light and power industries. It contains instructions for the preparation of surfaces and for the application of paints, and also a partial list of its customers.

CONDENSERS.—"Vent Condensers and Their Uses" is the title of bulletin No. 666 issued by the Cochrane Corporation, Seventeenth Street and Allegheny Avenue, Philadelphia, in which is described the use of vent condensers with water heaters. Illustrations are given showing the use of the vent condensers with various types of heaters, including horizontal, cylindrical, deaërating, open, etc.

SURGE ABSORBER.—Ferranti, Limited, Hollinwood, Lancashire, England, is distributing pamphlet Ta-746, covering the Ferranti surge absorber for lightning and surge protection.

MOTORS, SWITCHES, TRANSFORMERS, ETC.—The General Electric Company is distributing a series of pamphlets, GEA-67-255-263-288-302-308, covering its float switches, arc welder, high-speed "Built-in" type "KT" motors, auto-transformers, variable-voltage centrifugal drive, and arc suppressor plates for drum controllers respectively.

SAFETY SWITCHES. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued catalog 41-A, covering its complete line of safety switches, including industrial switches, motor-starting switches and meter-service switches. Special attention is called to the new type "WK-62" safety inclosed switch, "WK-60" line and the "WK-55" indsutrial line, which is now available in capacities of 400, 600 and 1,200 amp. A quick-make, quick-break compensator switch is also announced in this catalog. Comparative switch information and wiring data are included.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Casablanca, Morocco (No. 19,073), of automobile accessories such as head and spot lights, windshield wipers, spark plugs, etc.

Purchase and agency is desired in Dublin, Ireland (No. 19,075), for automobile accessories such as lamps, pumps, ball and roller bearings, etc.

An agency is desired in Lyon, France (No. 19,033), for electrical automobile equipment.

Purchase and agency is desired in Florence, Italy (No. 19,030), for electrical engines, vacuum cleaners, fans, reflectors, heaters, etc., and for radio sets and parts.

An agency is desired in Oruro, Bolivia (No. 19,067), for electrical machinery.

Purchase is desired in Athens, Greece (No. 19,034), of radio broadcasting and receiving sets.

An agency is desired in Salonika, Greece (No. 19,035), for radio sets, five to ten tubes.

An agency is desired in San Pedro Macoris, Dominican Republic (No. 19,029), for radio sets and parts.

Sole agency is desired in London, England (No. 19,032), for radio sets and parts. Also for refrigerating machines (No. 19,015).

An agency is desired in Warsaw, Poland (No. 19,045), for radio sets and parts.

An agency is desired in Gaspé, Canada (No. 19,031), for electric refrigerating machinery for home use.

Purchase is desired in Montevideo, Uruguay (No. 19,026), of electric elevators.

Purchase and agency is desired in Galway, Ireland (No. 19,123), for battery-charging outfits, household appliances, wiring and lighting devices and household lighting plants.

An agency is desired in Oruro, Bolivia (No. 19,181), for electrical supplies, especially wire and cable, installation material and lamps.

An agency is desired in Copenhagen, Denmark (No. 19,180), for radio loud speakers.

An agency is desired in Vienna, Austria (No. 19,182), for radio specialties and novelties.

Purchase and agency is desired in Casablanca, Morocco (No. 19,133), for storage batteries for automobiles, 100 or 150 per annum.

Purchase is desired in Cape Town, South Africa (No. 19,171), of electric wharf cranes.

Construction News

Projects, Plans, Bids and Contracts,
Contemplated or Under Way

New England States

READING, MASS.—The Municipal Electric Department contemplates building a work shop and garage, to cost from $40,000 to $50,000.

HARTFORD, CONN.—The installation of a large mercury boiler at its South Meadow station is under construction by the Hartford Electric Company.

NEW HAVEN, CONN.—Plans are under way by the United Illuminating Company for the erection of a substation at 244 Forbes Avenue.

Middle Atlantic States

BROOKLYN, N. Y. — The Brooklyn Edison Company has acquired a site on Ferris Street on the East River, on which it proposes to build a power plant.

CHATHAM, N. Y.—Permission has been granted the Eastern New York Utilities Corporation, Rensselaer, to extend its system, now serving part of the town, along the roads in school district No. 1 and along part of the North Chatham-Chatham Center Road.

DUNKIRK, N. Y.—Bids will be received by the Board of Water Commissioners, at the office of the assistant secretary, 425 Central Avenue, until Feb. 26, for the construction of a 6,000,000-gallon rapid sand filtration plant, low service pumps, wash tank, etc. The J. H. Chester Engineers, Union Bank Building, Pittsburgh, Pa., is engineer.

NEW YORK, N. Y.—The New York Edison Company plans to make alterations and improvements in its substation at 155 East Sixtieth Street.

ROCKWOOD, N. Y.—The Rockwood Power & Light Corporation, Gloversville, recently incorporated, plans to build a hydroelectric plant on Carago Creek, near Rockwood Hamlet, to develop about 300 hp., to supply electricity for cottages and summer resorts on Caroga Lake, West Canada Lake and Green Lake, which at present is not served with electricity. W. Donald Hyde, Gloversville, and William N. Wilkins, Mayfield, are interested in the project.

ATHENIA, N. J.—The Public Service Gas & Electric Company, Newark, is receiving bids for structural steel work for its proposed local sub-station and distributing plant, to cost about $300 000. The Public Service Production Company, Newark, is in charge.

HANOVER, N. J.—The Jersey Central Light & Power Company, Morristown, has acquired a site on the Passaic River in Hanover, for a proposed power plant, to cost about $200,000.

HOBOKEN, N. J.—The proposed plant of the United States Testing Company, 140 Hudson Street, New York, to be erected at Park Avenue and Fifteenth Street, to cost about $1,000,000, will be equipped for electrical operation.

NEWARK, N. J.—Bids will be received by George C. Bergen, County Purchasing Agent, Court House, until March 3, for electrical equipment for plant to be erected in connection with the proposed Hall of Records. Guilbert & Betelle, Chamber of Commerce Building, are architects.

HARRISBURG, PA.—The Harrisburg Light & Power Company is planning extensions in its transmission system for interchange of service with Pennsylvania Power & Light Company, Allentown.

MEADVILLE, PA.—Plans for the dairy plant to be erected by Moore Brothers on Race Street include a power plant.

SHEFFIELD, PA.—Plans for rebuilding the works of the Sheffield Glass Bottle Company, recently destroyed by fire with a loss of $100,000, include a power plant.

WARREN, PA.—Plans for the proposed new plant of the Paramount Furniture Company, to cost about $90,000, include a power plant, for which general contract has been awarded to G. Brown Company, Warren.

DANVILLE, VA. — Improvements are contemplated to the municipal electric plant, including the installation of automatic stokers and building a larger intake pipe from the bed of the river. The cost is estimated at $100,000.

WASHINGTON, D. C. — Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until March 9, for six electric generating sets, of 8 to 10 kw. capacity, driven by vertical kerosene or Diesel oil-burning engines.

WASHINGTON, D. C. — Bids will be received by the Chief Signal Officer, Signal Corps, Washington, until March 8, for one telephone switchboard (Proposal C. P. 22159-B-1); until March 9, for 40 ammeters, 150 condensers, 50 rheostats, 125 transformers, radio equipment, etc.

North Central States

DETROIT, MICH.—The budget of the Detroit Edison Company for 1926 provides for an expenditure of $28,000,000. The work will include the second section of the power house at Trenton Channel, and to add two 50,000-kw. turbines and three more boilers, and to install another 30,000-kw. turbine and three new boilers at the Marysville station. More than $7,000,000 will be expended for new substations. A new alternating-current susbtation will be erected on McKinstry Avenue, just north of Fort Street West, to cost $525,000; the connecting transmission and distribution lines will bring the total amount to $1,200,000; a 120,000-volt stepdown station on Mount Elliott Avenue and Eight Mile Road will be built, at a cost of $800,000. From this station 24,000-volt cables laid in conduits will radiate to feed adjacent substations, which will cost about $1,200,000. A 120,000-volt steel tower transmision line will extend from the station to the vicinity of Yates, where it will connect with the present 120,000-volt line running between Marysville and Bloomfield. The switching station near Yates, will cost $325,000, and the transmisison line from the Northeast station to Yates, $200,000. The plans call for 75,000 kva. in transformers for the stations at Bloomfield, Brownstown, Navarre and West Warren, to cost $350,000; seven 4,800-volt automatic reclosing substations will be erected in the city and suburban territory, at a cost of $700,000. Later in the year the Farmer Street heating plant will be converted into a direct-current substation, at a cost of $500,000. In addition to this about $1,000,000 will be expended on the existing overhead transmission and distribution systems. Extension to the central heating system, to cost about $3,000,000, is also under consideration.

ALLIANCE, OHIO. — The Ohio Public Service Company has secured a 10-year lighting contract and is planning extensions and improvements in the present system.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Feb. 26 for lead covered cable for the Division of Light and Power.

CLEVELAND, OHIO. — Plans for the addition to the plant of the Cleveland Automobile Company, to cost about $200,000, include the installation of power plant machinery, etc. General contract has been awarded to the William Dunbar Company, Cleveland.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Feb. 26 for furnishing and installing electric traveling crane for the new Kirtland pump house for the Division of Water and Heat.

CONNEAUT, OHIO. — The Cleveland (Ohio) Electric Illuminating Company, which has purchased the municipal electric plant, plans to remodel the local station for a substation. Extensions will be made in transmission lines in this section.

LOCKLAND, OHIO.—Electric power equipment will be installed in the two additions to be erected at the mattress factory of the Stearns & Foster Company, Wyoming Avenue, to cost about $215,000.

SPRINGFIELD, OHIO.—The Ohio Edison Company plans to start work soon on a proposed steam-operated power plant on Mad River, near Springfield, with an initial capacity of 27,000 hp. The plans provide for an ultimate output of 135,000 hp. The initial cost is estimated at $1,300,000, with transmission system.

CHICAGO, ILL.—The proposed plant of the Mills Novelty Company, 221 South Green Street, to be erected at 4110 Fullerton Avenue, at a cost of $500,000, will be equipped with electrically-operated machinery.

CHICAGO, ILL.—Bids will be received at the Office of the Signal Corps Procurement District, Chicago, until March 1, for telephone supplies, including 400 receiver caps, 2,000 receiver shells, 1,000 telephone transmitter heads. (Circular 27).

EAST GRAND FORKS, MINN.—Bids, it is understood, will be asked by the Otter Tail Power Company, Fergus Falls, about April 1 for construction of a new power plant, to cost about $400,000. Two 2,000-hp. units will be installed.

ROCHESTER, MINN.—Bids will be received by S. L. Seaman, Clerk of Board of Education, until Feb. 25 for construction of central power plant and all equipment. Harold H. Crawford, is architect; and the Frank Tustison Company, 456 Northwestern Life Building, Minneapolis, is engineer.

WACONIA, MINN.—Bids are being received by the Waconia (Minn.) Sorghum Mills, Inc., for power equipment, including generators, boilers, motors, vacuum evaporators, power transmission, pumps, filters, etc., for a proposed factory to be built this spring at Cedar Rapids, Iowa. Edward Wessale is president and general manager.

ST. LOUIS, MO.—Extensions and improvements involving an expenditure of about $11,000,000 are contemplated by the Union Electric Light & Power Company. The work will include additions to the Cahokia and Ashley power plants, substation, line extensions, etc.

HARTINGTON, NEB.—The City Council is considering plans submitted for financing and constructing a new electric light plant.

MERNA, NEB.—The erection of a transmission line from Merna to Anselma, a distance of 12 miles, is contemplated by the Nebraska Electric Power Company, Broken Bow.

Southern States

CAPE LOOKOUT, N. C.—Bids will soon be asked by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for two 100-ft. radio towers for Cape Lookout (Specification 5182).

GROVELAND, FLA.—Plans for rebuilding the lumber and woodworking mill of the J. Ray Arnold Lumber Company, recently damaged by fire with a loss of about $100,000, include a power plant.

TAMPA, FLA. — The Tampa Electric Company will install an additional 12,500-kw. unit and four boilers in its West Jackson Street station. The boiler room is to be extended, a 200-ft. stack erected, and an outdoor substation will be enlarged and an additional feeder installed to tie in the Eleventh Avenue substation. Stone & Webster, Inc., Boston, is supervising engineer.

BIRMINGHAM, ALA.—The City Commissioners are considering a bond issue of $300,000 for extensions to the fire-alarm system, including a new station.

BIRMINGHAM, ALA. — Plans for the proposed cement mill of the Phoenix Portland Cement Company of Alabama, Inc., Jefferson County Bank Building, to be erected near the city, to cost about $1,750,000, include a power plant.

NATCHEZ, MISS.—The installation of an ornamental lighting system, to cost about $25,000 is under consideration by the City Council.

ARKADELPHIA, ARK.—Plans for rebuilding the plant of the Arkadelphia Milling Company, recently destroyed by fire with a loss of about $275,000, include a power house.

RUSSELLVILLE, ARK. — Plans are being considered by the Arkansas Light & Power Company, Pine Bluff, for building a steam-operated electric plant, to cost about $500,000. Extensions to its transmission lines in this section are also contemplated.

CRYSTAL CITY, TEX.—Arrangements are being made by the Texas Central Power Company, San Antonio, to extend its transmission lines to several towns in this section. Work will begin at once on the construction of a local power plant, which will furnish power to operate a number of irrigating pumps in the Nueces River Valley.

LIBERTY, TEX. — The Dewars Canal Company has contracted with the East Texas Electric Company, Beaumont, to supply electricity to operate the pumps for its irrigation system. The East Texas company will extend its transmission lines to the pumping station of the canal company.

LUBBOCK, TEX.—Bids will be received by the City of Lubbock until Feb. 24 for Contract No. 23, calling for furnishing materials, equipment and construction of an addition to the city power plant. Hawley & Roberts are consulting engineers.

WACO, TEX.—Bids will be received by the Mayor and Board of City Commissioners until March 2 for construction of sewage treatment plant of the activated sludge type, including two pumping stations, pumping equipment, motor drive equipment and accessories, starting panels, float switches, wiring, air compressors, etc. The Terrell Bartlett Engineers' Inc., Calcasieu Building, San Antonio, is engineer. V. G. Koch is city engineer.

Pacific and Mountain States

CHEHALIS, WASH. — A franchise has been granted the Puget Sound Power & Light Company, Seattle, to erect a transmission line over the Newaukum and Boistfort road, a distance of about 1½ miles.

EVERETT, WASH. — Plans have been prepared by the Puget Sound Power & Light Company, Seattle, for an addition to its local power plant, to cost about $20,000.

SEATTLE, WASH. — Application has been filed by the City Light Department with the R. K. Tiffany, supervisor of hydraulics, for a permit for reservoir and for water rights for an expansion to the Skagit River hydroelectric project, to cost about $11,000,000. The work will include construction of dam 350 ft. high, 800 ft. long, spanning Diablo Canyon, reservoir, etc.

SPOKANE, WASH. — Addison-Miller, Inc., Hillyard, Wash., operating the Great Northern ice plant, plans to install electric power equipment in a proposed local ice-manufacturing plant to cost about $150,000.

CASCADE LOCKS, ORE. — Extensions and improvements are contemplated by the Skamania Light & Power Company in its system as recommended by the Public Service Commission.

SALEM, ORE. — The Oregon Pulp & Paper Company plans to install electric power equipment in a proposed addition, to its plant, to cost about $450,000.

BERKELEY, CAL. — Plans are being prepared by Frank B. Ray, city electrical engineer, for the installation of ornamental lamps on Shattuck Avenue, from Addison to Center Streets, and on portions of Hillegass Avenue and other streets in the residential section.

LONG BEACH, CAL.—Plans are under way for the installation of ornamental lamps on American Avenue, from the Ocean Boulevard to Anaheim Street. Single 1,000-cp. units will be used. R. D. Van Alstine is city engineer.

LOS ANGELES, CAL.—Plans are under way by the Bureau of Power and Light for the construction of a 7,000-hp. hydroelectric plant about 1½ miles south of the Haiwee Reservoir along the aqueduct in Owens Valley. Bids, it is understood, will soon be asked on two generators, two water wheels and 10,000 feet of penstock.

OAKLAND, CAL.—Plans are under way by the Great Western Power Company, San Francisco, for extensions to its local substation on Fourth Avenue, to cost $150,000.

PALO ALTO, CAL.—The City Council is considering the installation of ornamental lamps on El Camino Real, between Stanford Avenue and the Page Mill Road. A. V. Youens is city electrician.

PITTSBURG, CAL. — Plans are being considered by the Pacific Gas & Electric Company, San Francisco, for an addition to the substation of the Columbia Steel Corporation, to cost about $50,000.

SACRAMENTO, CAL.—Plans are under way by the Great Western Power Company, San Francisco, for the erection of a steel tower transmission line from its Brighton substation, near Sacramento, to Merced, where it will connect with the system of the San Joaquin Light & Power Corporation. The cost is estimated at $2,000,000.

SAN FRANCISCO, CAL. — The Park Commission is considering the purchase of four high pressure centrifugal pumps and motors for use in the Golden Gate Park Irrigation system. B. P. Lamb is secretary.

WILMINGTON, CAL.—Plans have been approved by the Municipal Art Commission of Los Angeles for the installation of ornamental lamps on a number of local streets as follows: On Canal Avenue, to cost $10,000; on Roan, Lakme, Fries, Lagoon, Ravenna, Neptune, Bayview and Osland Streets, to cost $3,000 each.

SODA SPRINGS, IDAHO.—The City Council plans extensions and improvements in the municipal electric lighting plant.

TWIN FALLS, IDAHO.—Plans are being considered by the City Council for the construction of a 10,000-hp. municipal hydroelectric plant at Augre Falls on the Snake River. E. V. Berg is city engineer.

LEHI, UTAH.—Plans are under consideration by the City Council for the erection of a municipal electric light and power plant.

LIMON, COLO.—The City Council has authorized an appropriation of $16,668, for extensions to the municipal electric light plant.

CLOVIS, N. M.—Surveys are being made by the New Mexico Utilities Company for the proposed high-tension lines to be erected from its central power plant to various points in eastern New Mexico, the first of which will be to Portales and Texico. The transmission system, it is said, will be connected with the transmission lines of its affiliated companies in Texas, which now extend to Lubbock, Plainview and other points in that section.

Canada

WINNIPEG, MAN.—Tenders will be received at the office of C. J. Brown, City Clerk, addressed to the Chairman, Committee on Public Utilities, until March 1 for furnishing six 5,000-kva., single-phase transformers, three to be delivered to the Terminal Station, Winnipeg, and three to the power house at Pointe du Bois.

WINNIPEG, MAN.—Bonds to the amount of $10,000,000 have been issued by the Manitoba Power Company, Ltd., of which $7,500,000 will be used for refunding purposes, and the remainder for new construction work, including the installation of a third unit in the hydro-electric plant on the Winnipeg River at Grand Falls, and to finance the erection of a 15-mile, steel-tower, double-circuit transmission line, which will tie-in with the transmission system of the Winnipeg Electric Company.

MEADOWVALE, ONT.—The installation of an electric system in Meadowvale is under consideration by the Hydro-Electric Power Commission of Ontario.

STE DIDACE, QUE.—Plans are being considered by O. Dupesue and others, Maisonneure, a suburb of Montreal, for building a 100,000-hp. plant at Ste Ursule Falls, on the Maskinonge River at Ste Didace, to cost about $150,000.

SHAWINIGAN FALLS, QUE.—The construction of an electric power plant and renewing a 14-ft. penstock is under consideration by the Shawinigan Water & Power Company, 611 Power Building, Montreal. The cost is estimated at $2,000,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Jan. 12, 1926)

1,569,367. BRUSHHOLDER CONTACT FINGER; H. F. Hartman, Pittsburgh, Pa. App. filed April 2, 1925. Having a renewable brush-engaging tip.

1,569,368. RECTIFIED-CURRENT COMMUTATOR MOTOR; R. E. Hellmund, Pittsburgh, Pa. App. filed Jan. 5, 1921. Adapted for railway work. A pulsating-current motor adapted to operate on a double-wave rectifier in such manner as to eliminate, as far as possible, the objectionable harmonics in the alternating supply currents and at the same time to mitigate the harmful effects of ripples in the motor circuits.

1,569,373. CONTROL SYSTEM; H. D. James, Edgewood Park, Pa. App. filed Nov. 20, 1920. Hoist-control system for the dynamic braking of an alternating-current motor that is used in connection with hoist installations.

1,569,374. CONTROL APPARATUS; H. H. Johnston, Edgewood Park, Pa. App. filed May 23, 1919. For use in automatic control systems requiring protection by the familiar limit switch and overload trip device. A single relay device having the double function of both a limit switch and an overload trip, the parts being so related that a single actuating coil may be utilized for independently performing the two functions, that is to say, under different operating conditions corresponding to the normal maximum and to an overload current.

1,569,376. FURNACE RESISTOR MOUNTING; A. D. Keene, Pittsburgh, Pa. App. filed Nov. 20, 1923. For a double-layer resistor.

1,569,385. CONDENSER CASING; R. E. Marbury, Wilkinsburg, Pa. App. filed Aug. 18, 1921. Casing for condensers of the oil-impregnated type used for power-factor correction; leak-proof and in which the condenser elements are maintained under pressure by the structure of the container.

1,569,409. SYSTEM OF CONTROL; S. A. Staege, Pittsburgh, Pa. App. filed May 15, 1919. Equipped with means for effecting a very quick stopping of the motor in case of an emergency without causing a reversal of the motor, by using a differential-gear mechanism, one end portion of which is rotated in accordance with the speed rotation of the rolls and the other end portion of which is rotated at a constant speed by any auxiliary source of power. The central portion of the differential-gear mechanism, which rotates in a direction determined by the relative speeds of the two end portions, controls a switch which effects the disconnection of the motor from the supply circuit in a manner to prevent any reverse operation of the motor.

1,569,415. ELECTRIC FURNACE HEATING UNIT; J. C. Woodson, East Pittsburgh, Pa. App. filed Jan. 25, 1924. With both terminals located at each end and with a unitary terminal and supporting structure.

1,569,416. SWITCH; A. H. Bates, Elgin, Ill. App. filed Aug. 5, 1922. Single push-button type of switch.

1,569,460. ELECTRIC LAMP INDICATOR; R. B. Cressman, Philadelphia, Pa. App. filed July 2, 1923. To determine when the lamp is no longer efficient or giving a full equivalent in the quantity or color of the light for the electricity consumed.

1,569,463, 1,569,464. ELECTRIC ARC FURNACE; J. L. Dixon, New York, N. Y. App. filed Sept. 5, 1919. Arcs established between vertical electrodes and the metal itself. Using a three-phase transformer which is capable of delivering to the electrodes unequal voltages and which furthermore is so arranged that these voltages may be adjusted independently of each other.

1,569,482. BOBBIN FOR TRANSFORMER WINDINGS AND THE LIKE; F. Haberle, Fschieren, near Dresden, Germany. App. filed July 5, 1921 (granted under the provisions of the act of March 3, 1921). To prevent injury of the insulation of windings of separate bobbins during the manufacture of the latter and also within the finished bobbin-packet or bundle.

1,569,485. COCK PROVIDED WITH ELECTRIC LIQUID-HEATING MEANS; A. F. Hanson, Amsterdam, Netherlands. App. filed March 13, 1925.

1,569,528. ATTACHMENT PLUG; L. D. Yager, Fort Wayne, Ind. App. filed Nov. 9, 1923. Multiway attachment plug.

1,569,541. CURRENT-CONVERTING MEANS; F. J. Fischer, Dresden, Germany. App. filed April 20, 1922. Device operating in a manner similar to a transformer and designed mainly for very high voltages. It can be applied for instance for the purposes of measuring and testing high-current plants.

1,569,593. RELAY; P. K. van der Sterr, Frankfort-on-the-Main, Germany. App. filed Aug. 29, 1921. Induction type; selective relay for protective purposes that shall be adapted for use in a complicated network which requires that certain relays operate before others in case abnormal conditions obtain.

1,569,599. ELECTROMAGNETIC CHUCK; W. Zehnder, Granichen, Switzerland. App. filed Oct. 5, 1921.

1,569,611. ELECTRIC CONTROLLER; F. H. Bullinger, Yonkers, N. Y. App. filed July 29, 1921. For farm-lighting power plant; to insure proper sequence of control and proper operation of the parts.

1,569,630. ELECTRON-DISCHARGE DEVICE; T. R. Griffith, Dover, N. J. App. filed Dec. 12, 1923. High-power vacuum tubes with improved electrode-supporting structure.

1,569,651. GOVERNING DEVICE; W. H. Costello, Milwaukee, Wis. App. filed Sept. 1, 1921. For governing machines to control the rate of speed changes and also to maintain the rate of acceleration substantially uniform.

1,569,669. BAR-LOCK SWITCH; C. Norton, New York, N. Y. App. filed April 11, 1923. As used on elevator hatchway doors.

1,569,683. ELECTRIC SWITCH; C. F. Schwennker, Schenectady, N. Y. App. filed Jan. 5, 1924. Of the fluid break type, adapted to control high-potential circuits arranged so that the pressure of the gas generated by the arc formed upon opening the switch serves to accelerate the opening movement.

1,569,713. CONTROLLER; W. C. Carr, Buffalo, N. Y. App. filed Sept. 10, 1921. For electric motors especially adapted for use on electric vehicles.

1,569,723. INSTRUMENT TRANSFORMER; W. K. Dickinson, Lynn, Mass. App. filed Aug. 14, 1925. Separable; to permit it to be opened and placed around a current-carrying conductor.

1,569,796. ELECTRIC SOLDERING TOOL; E. L. Watson, Bode, Iowa. App. filed July 25, 1924. Using an electric arc as the source of heat for the point or head of the tool.

1,569,803, 1,569,804. RELAY; B. E. Getchell, Plainville, Conn. App. filed July 10, 1922. Overload relay or automatic circuit breaker intended for use with motor-starting switches. Cartridge form, adjustable.

1,569,815. AUTOMATIC CUT-OFF FOR HEATING DEVICES; H. A. Kirkland, Portland, Ore. App. filed March 5, 1920. Material of relatively low fusibility permanently confined within a heating wall, a movable member mounted upon a shaft extending into the fusible material within the receptacle, the member being held in fixed position by the material when hard and liberated for movement when soft.

(Issued Jan. 19, 1926)

1,569,864. ELECTRIC SWITCH; H. E. Leppert, New Britain, Conn. App. filed Aug. 4, 1925. Toggle or lever type in which the indicator can be readily applied or removed when desired.

1,569,922. ELECTRIC CONTROL SYSTEM FOR ALL MOVABLE ELEMENTS OPERATING BY A VERY SMALL POWER, AND CHIEFLY FOR THE GYROSCOPIC COMPASS; E. Granat, Paris, France. App. filed May 14, 1924.

1,569,928. CAR-HEATING SYSTEM; W. G. Hartwig, Chicago, Ill. App. filed Dec. 10, 1923. In which reduction of the peak-load is obtained by cutting out the heating current of the individual cars during periods in which the motors are taking the greatest amount of current, as when they are accelerating after a stop and going up an incline with the car loaded.

1,569,933. THERMOSTATIC SWITCH; R. H. Houk, Joliet, Ill. App. filed July 20, 1922.

1,569,972. PULL-OFF PLUG; J. B. Glowacki, Chicago, Ill. App. filed Aug. 11, 1919. In which there can be no electrical connection between the two parts until the contacts have been completely shielded from contact with the fingers of the operator; having mutually supporting parts in addition to the contacts.

1,569,981. EXPULSION-TYPE REPEATING FUSE; T. F. Johnson, Jr., Atlanta, Ga. App. filed Aug. 12, 1922. High-voltage; after the fuse originally in circuit is blown, the apparatus, following a predeterminable time interval, automatically puts a second fuse in circuit.

1,570,012. ELECTRIC HAIR WAVER; R. P. Simmons, Cleveland, Ohio. App. filed July 31, 1924.

1,570,041. ELECTRODE FOR HIGH-FREQUENCY GENERATORS; R. G. Clark, Chicago, Ill. App. filed March 12, 1923. Used in therapeutic treatment.

1,570,084. ELECTRIC RESISTANCE ELEMENT; T. C. Russell, Chicago, Ill. App. filed Feb. 7, 1924. Terminals for non-metallic resistance elements which will stand up under high temperatures and will resist corrosion obtained by plating electrolytically with metal such as nickel, chromium, cobalt or other suitable metal.

1,570,101. HOISTING AND LOWERING CONTROL MECHANISM; E. B. Thurston, Toledo, Ohio. App. filed Sept. 30, 1922. For use in alternating-current installations for handling loads which have at all times a tendency to drive the motor, as in hoisting and lowering.

1,570,105. ELECTRIC COUPLING FOR RAILWAY VEHICLES; H. E. Van Dorn, Chicago, Ill. App. filed Feb. 11, 1920. For connecting together any desired number of separate circuits on one vehicle with the corresponding circuits on another, regardless of which end of either vehicle is directed toward the other vehicle.

1,570,109. ALTERNATING-CURRENT MOTOR; H. Weichsel, St. Louis, Mo. App. filed Nov. 26, 1923. Synchronous motor which may be directly connected to the line in starting without the manipulation of starting resistances or reorganizing of circuits during the starting period or after the machine has attained synchronous speed. Accomplished by providing a combination of resistances and inductances connected in parallel in the circuits of the windings which act as starting windings and as the induced secondary windings when the machine is operating as an induction motor at speeds below synchronism.

1,570,162. MEANS AND METHOD FOR WARMING FLOORS; J. W. McKeehan, Contra Costa County, Cal., and G. J. Henry, San Francisco, Cal. App. filed Nov. 13, 1922. To remove the chill from the floor of rooms and to warm the strata of air in the room adjacent to the floor. A resistance element located beneath the floor.

1,570,212. APPARATUS FOR THE PRODUCTION OF ELECTROLYTIC IRON; E. Duhme, Berlin-Charlottenburg, Germany. App. filed June 17, 1924. In which an anode of iron is immersed in the electrolytic bath so that at the cathode electrolytic iron is deposited.

1,570,237. ELECTRIC SWITCH; B. E. Getchell, Plainville, Conn. App. filed Sept. 9, 1922. An insulating base, stationary switch contacts carried thereby, an oscillating carrier, a blade loosely carried thereby and adapted to engage said contacts, and a cotter pin passing through said blade for detachably securing it in said carrier.

1,570,245. ELECTRIC SWITCH; A. E. Greene, Medford Hillside, Mass. App. filed Sept. 1, 1922. Pole-line oil switch adapted to carry current and control a circuit, although not necessarily adapted especially to interrupt current.

1,570,255. FIRE-ALARM APPARATUS; H. Hunke, Taylor, Tex. App. filed Oct. 16, 1923. Annunciator.

1,570,265. ELECTRODE FOR DISCHARGE TUBES; K. A. Lebbink, Eindhoven, Netherlands. App. filed July 5, 1923. Adapted for the grids of tubes provided with three or more electrodes. Method of attaching the coils to the support.

1,570,286. ELECTRIC CIGAR LIGHTER; A. Schoeller, Frankfort-on-the-Main, Germany. App. filed March 13, 1924.

1,570,301. ELECTRIC HEATING SYSTEM; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed July 1, 1921. Heat generator and distributing system.

1,570,347. CONVERTER SYSTEM; H. M. Hobart, Schenectady, N. Y. App. filed March 17, 1922. An intermediate transformation of the electricity consumed by the apparatus with the object of eliminating the necessity for ever consuming a lagging current.

1,570,369. CONTROL SYSTEM; H. L. Blood, North Plainfield, N. J., and R. C. Deale, Plainfield, N. J. App. filed Aug. 25, 1923. For governing the operation of machine tools. A control system that shall automatically control a feed motor and reverse the direction of rotation of such motor at each end of the stroke of a reciprocating member and that shall control the feed motor at will while insuring against automatic operation thereof.

1,570,420. ELECTRICAL CONTACT MAKER AND BREAKER; V. Yngve, South Orange, N. J. App. filed June 20, 1924. The contact points of a circuit maker and breaker or the contacting surface of a commutator of copper, bronze or the like is covered with a thin coating of metallic chromium.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

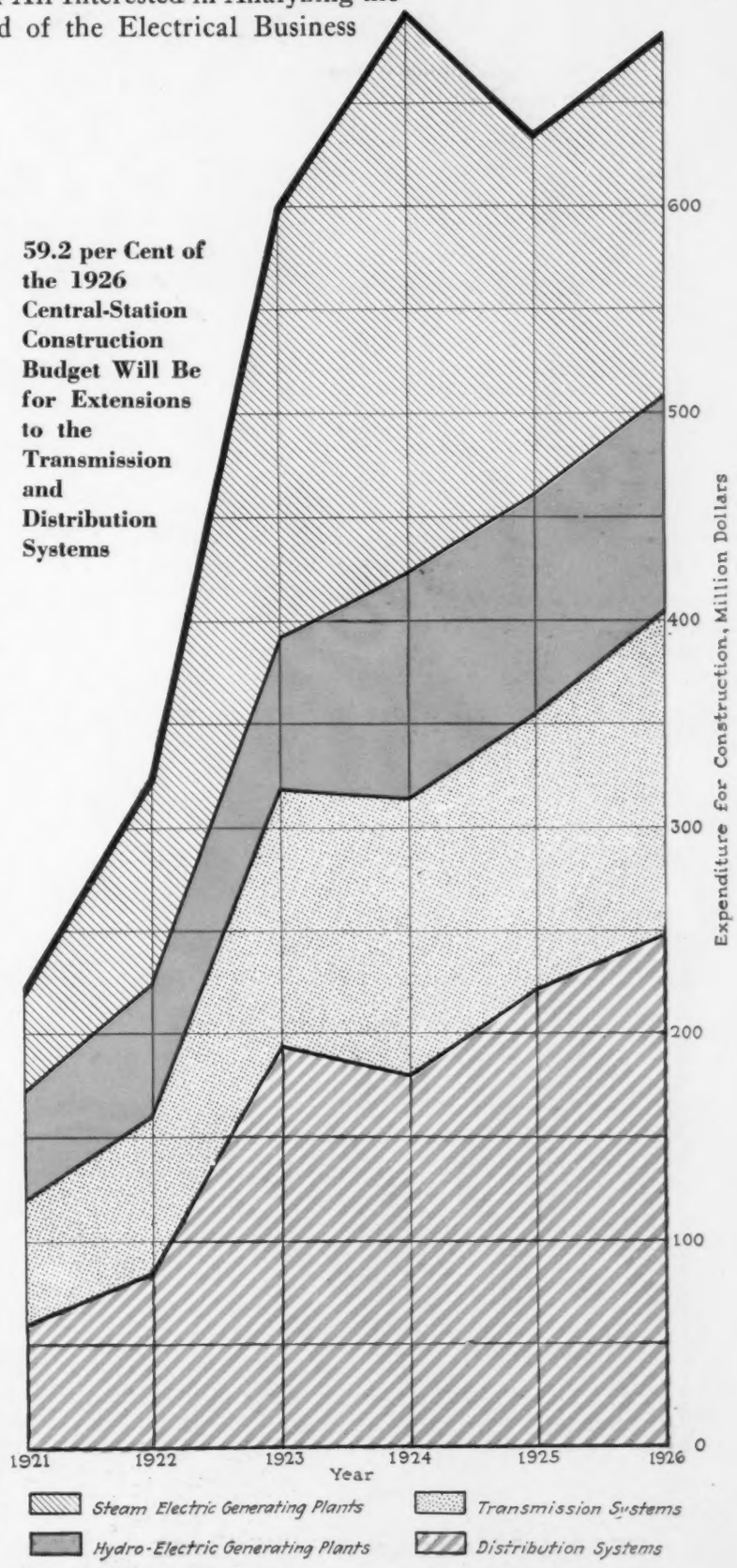
Six Billions for Construction

THE large amounts which the electric light and power companies of the country are spending for additions and extensions to their generation, transmission and distribution systems exceed the average man's sense of comprehension. One may feel perfectly at home juggling with hundreds of thousands or even millions, but when it comes to hundreds of millions or even billions the ordinary man simply loses his sense of proportion.

The fact that the electric light and power companies of the country are spending approximately six billion dollars during the present decade for new equipment simply means to most men that the industry is recording a very large growth indeed, but the actual size of that growth is not made apparent. A clearer picture is presented when certain comparisons are made.

The amount which the electric light and power companies of the country are spending for extensions during the present decade is twice the present annual budget of the federal government. It is six times any congressional appropriation made up to the time the United States entered the World War. It is seven times the value of the annual wheat production, eleven times the value of the annual oats production and eighteen times the value of the annual potato production. It is equal to the value of construction of all kinds taking place in the United States during 1925. Extensive research fails to disclose any other industry which is keeping up with the pace being set by the electric light and power industry during the present decade.

The outstanding fact disclosed by the construction figures for the first seven years of the decade is that during 1926 almost two hundred and fifty million dollars, or considerably more than one-third of the total expenditures, will be for extensions to the distribution systems of the country, a figure greatly in excess of any other construction item. Such a segregation of the nation's construction budget is clearly indicative of a new alignment in central-station operations. Prior to 1925 the expenditure for steam-electric generating plants was the leading item of central-station expansion, followed by the value of distribution-line extensions. With 1925, however, the industry's expenditures for steam-electric plants fell about forty-eight million dollars under and in 1926 they will be about seventy-three million dollars under the amount to be spent for extensions to the distribution systems of the country.



Industrial Electrification in the North Central States

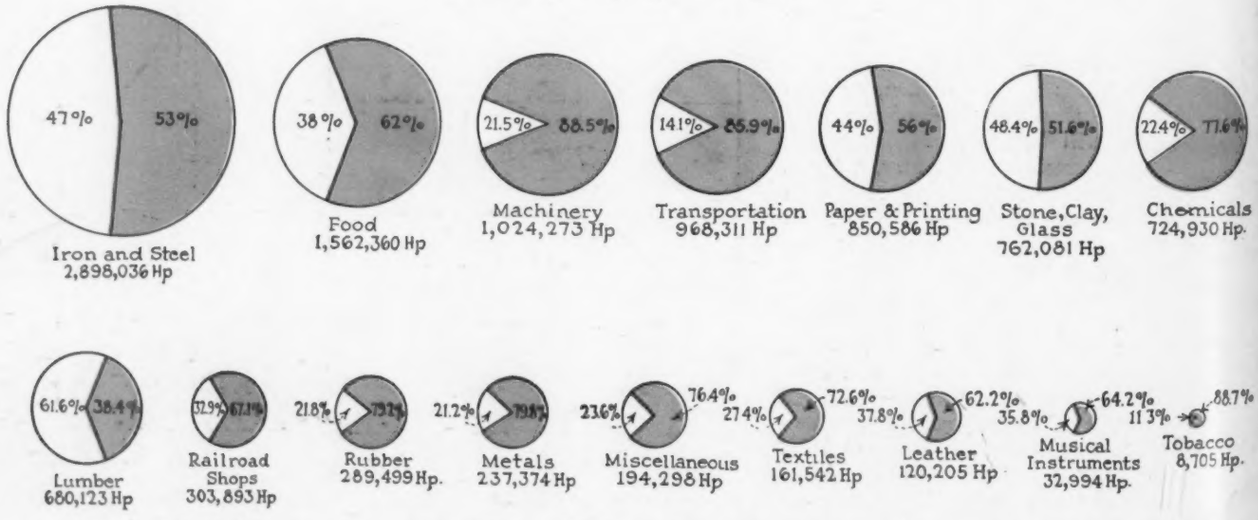
A STUDY of the industries operating in the North Central States brings out the fact that this is a section of many large industries. There are three industrial groups with an aggregate primary power of more than a million horsepower and eight industries with more than five hundred thousand horsepower. There are four industries which consume over a billion kilowatt-hours of electrical energy per annum, these industries being, in order of importance, the iron and steel, the food, the paper and printing, and the transportation equipment industries. In two of these, the iron and steel and the paper industries, the private plant is the predominant factor.

The rating of the power machinery installed in the manufacturing establishments of the North Central States is greater than that reported by any other section of the nation—10,819,210 hp. Almost 85 per cent of this total primary power is concentrated in the five industrial states of Illinois, Indiana, Michigan, Ohio and Wisconsin. Based upon returns received in a recent survey by the ELECTRICAL WORLD the estimate is made that 2,311,227 hp. of this total power is installed in private electric generating plants and that 4,613,377 hp. is in electric motors which are run by energy purchased from central-station companies. Using these figures as a basis, it is estimated that industry as a whole in the North Central States is now 64 per cent electrified. This is a high degree of electrification compared with other industrial sections of the country, the New England States and the Middle Atlantic States reporting 58.2 per cent and 59.6 per cent electrification respectively.

The North Central States are outstanding in that every one of the seven largest manufacturing industries is highly electrified. Of these industries the machinery industry leads with an 88.5 per cent electrification and the transportation industry follows with an 85.9 per cent electrification. The largest industry of the section, the iron and steel industry, is 53.0 per cent electrified. These electrification figures do not, however, in any way indicate the undeveloped power field of the central stations operating in this section. While the manufacturing industries of the section are estimated to be 64.0 per cent electrified, a large part of this electrification is from private generating plants, approximately 42.3 per cent of the energy consumed by the industries of the section being privately generated. The industries of the section report 2,816 private electric plants, with a prime-mover rating of 2,311,227 hp. A very large part of these private plants are possible of elimination through the substitution of energy generated in central-station plants. New industrial uses for electrical energy are being put into practice and plants are constantly applying industrial uses already accepted.

All of which serves to bring out the fact that while the power engineers of the companies operating in the North Central States have accomplished herculean tasks in the past, the future offers still greater fields for the employment of their power sales abilities.

Of the twelve states comprising the North Central section, Illinois reports the highest degree of electrification—72 per cent. In fact, Illinois is only exceeded by two or three other states in the Union in the degree of electrification of its manufacturing industries. The manufacturing plants of this state consumed a total of 2,083,174,000 kw.-hr. of electrical energy during the year 1924, of which 61.2 per cent was purchased from central-station companies.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

Some of the Leading Manufacturing Industries of the North Central States Are Very Highly Electrified